



IQC-2110 RF SIGNAL RECORDER

CAPTURE & PLAYBACK USING THE
TEKTRONIX RSA5000 AND RSA6000 SERIES,
AGILENT X-SERIES AND ROHDE & SCHWARZ
FSV AND FSW SIGNAL ANALYZERS

OPERATING INSTRUCTIONS

This is a preliminary manual. Specifications, limits, and text are subject to change without notice. The information within this manual was as complete as possible at the time of printing. Bird Technologies Group and X-Com Systems are not liable for errors.

Go to www.xcomsystems.com for the latest revision of this manual.

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Instruction Book P/N 920-IQC2110 Rev. P5



Safety Precautions

The following are general safety precautions that are not necessarily related to any specific part or procedure, and do not necessarily appear elsewhere in this publication. These precautions must be thoroughly understood and apply to all phases of operation and maintenance.

WARNING

Keep Away From Live Circuits

Operating Personnel must at all times observe general safety precautions. Do not replace components or make adjustments to the inside of the test equipment with the high voltage supply turned on. To avoid casualties, always remove power.

WARNING

Do Not Service Or Adjust Alone

Under no circumstances should any person reach into an enclosure for the purpose of service or adjustment of equipment except in the presence of someone who is capable of rendering aid.

WARNING

Safety Earth Ground

An uninterruptible earth safety ground must be supplied from the main power source to test instruments. Grounding one conductor of a two conductor power cable is not sufficient protection. Serious injury or death can occur if this grounding is not properly supplied.

WARNING

Resuscitation

Personnel working with or near high voltages should be familiar with modern methods of resuscitation.

WARNING

Remove Power

Observe general safety precautions. Do not open the instrument with the power on.

Safety Symbols

WARNING

Warning notes call attention to a procedure, which if not correctly performed, could result in personal injury.

CAUTION

Caution notes call attention to a procedure, which if not correctly performed, could result in damage to the instrument.



The caution symbol appears on the equipment indicating there is important information in the instruction manual regarding that particular area

Note: *Calls attention to supplemental information.*

WARNING STATEMENTS

The following safety warnings appear in the text where there is danger to operating and maintenance personnel, and are repeated here for emphasis.

WARNING

Heavy load. Do not attempt to lift unaided.

On page 5.

WARNING

Ensure that the correct cords are used. Only cords with of the proper type with the correct power rating should be used. Otherwise, a potential shock and/or fire hazard may occur.

On page 7.

WARNING

Do not block access to the power cords and connection to the mains. Ensure that the cords are easily accessible in cases of emergency shutdown and quick disconnection.

On page 7.

WARNING

Never attempt to connect or disconnect RF equipment from the transmission line while RF power is being applied. Leaking RF energy is a potential health hazard.

On page 8.

WARNING

Ensure all power switches are in the off position before applying AC power.

On page 8 and 14.

WARNING

Do not operate with the panel removed. Doing so could result in personal injury.

On page 25.

WARNING

To avoid personal injury, disconnect the power cord from the AC line before performing any maintenance, including fuse replacement or changing the line voltage setting.

On page 45.

CAUTION STATEMENTS

The following equipment cautions appear in the text and are repeated here for emphasis.

CAUTION

Always use the protective foam insert when transporting the Data Pack. Otherwise, the drives may become dislodged and damaged in transit.

On page 5.

CAUTION

Do not block airflow. The air intake vent on the sides and exhaust in the rear of the system must not be obstructed.

On page 6.

CAUTION

Avoid installing the IQC system near equipment that exhausts or radiates excessive heat (such as power amplifiers or DC power supplies). Proper ventilation should always be considered as part of the installation location.

On page 6.

CAUTION

Always be certain the 115/230 voltage selector is set to the proper voltage before AC power is applied.

On page 7.

Safety Statements

USAGE

ANY USE OF THIS INSTRUMENT IN A MANNER NOT SPECIFIED BY THE MANUFACTURER MAY IMPAIR THE INSTRUMENT'S SAFETY PROTECTION.

USO

EL USO DE ESTE INSTRUMENTO DE MANERA NO ESPECIFICADA POR EL FABRICANTE, PUEDE ANULAR LA PROTECCIÓN DE SEGURIDAD DEL INSTRUMENTO.

BENUTZUNG

WIRD DAS GERÄT AUF ANDERE WEISE VERWENDET ALS VOM HERSTELLER BESCHRIEBEN, KANN DIE GERÄTESICHERHEIT BEEINTRÄCHTIGT WERDEN.

UTILISATION

TOUTE UTILISATION DE CET INSTRUMENT QUI N'EST PAS EXPLICITEMENT PRÉVUE PAR LE FABRICANT PEUT ENDOMMAGER LE DISPOSITIF DE PROTECTION DE L'INSTRUMENT.

IMPIEGO

QUALORA QUESTO STRUMENTO VENISSE UTILIZZATO IN MODO DIVERSO DA COME SPECIFICATO DAL PRODUTTORE LA PROZIONE DI SICUREZZA POTREBBE VENIRNE COMPROMESSA.

SERVICE

SERVICING INSTRUCTIONS ARE FOR USE BY SERVICE - TRAINED PERSONNEL ONLY. TO AVOID DANGEROUS ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING UNLESS QUALIFIED TO DO SO.

SERVICIO

LAS INSTRUCCIONES DE SERVICIO SON PARA USO EXCLUSIVO DEL PERSONAL DE SERVICIO CAPACITADO. PARA EVITAR EL PELIGRO DE DESCARGAS ELÉCTRICAS, NO REALICE NINGÚN SERVICIO A MENOS QUE ESTÉ CAPACITADO PARA HACERLO.

WARTUNG

ANWEISUNGEN FÜR DIE WARTUNG DES GERÄTES GELTEN NUR FÜR GESCHULTES FACHPERSONAL.

ZUR VERMEIDUNG GEFÄHRLICHER, ELEKTRISCHER SCHOCKS, SIND WARTUNGSARBEITEN AUSSCHLIEßLICH VON QUALIFIZIERTEM SERVICEPERSONAL DURCHZUFÜHREN.

ENTRETIEN

L'EMPLOI DES INSTRUCTIONS D'ENTRETIEN DOIT ÊTRE RÉSERVÉ AU PERSONNEL FORMÉ AUX OPÉRATIONS D'ENTRETIEN. POUR PRÉVENIR UN CHOC ÉLECTRIQUE DANGEREUX, NE PAS EFFECTUER D'ENTRETIEN SI L'ON N'A PAS ÉTÉ QUALIFIÉ POUR CE FAIRE.

ASSISTENZA TECNICA

LE ISTRUZIONI RELATIVE ALL'ASSISTENZA SONO PREVISTE ESCLUSIVAMENTE PER IL PERSONALE OPPORTUNAMENTE ADDESTRATO. PER EVITARE PERICOLOSE SCOSSE ELETTRICHE NON EFFETTUARE ALCUNA RIPARAZIONE A MENO CHE QUALIFICATI A FARLA.

About This Manual

This manual covers the operating and maintenance instructions for the following models:

IQC-2110

Changes to this Manual

We have made every effort to ensure this manual is accurate. If you discover any errors, or if you have suggestions for improving this manual, please send your comments to our Solon, Ohio factory. This manual may be periodically updated. When inquiring about updates to this manual refer to the part number and revision on the title page.

Specifications, limits, and text are subject to change without notice. The information within this manual was as complete as possible at the time of printing. Bird Electronic Corporation is not liable for errors.

Layout

Introduction - Describes the features of the IQC.

Set Up - Describes the set up of the IQC including various configurations and wiring diagrams.

Operation - Lists the parameters, memory usage, and other specifications.

Remote Device Control - Describes how to use the remote functioning of the IQC.

IQC File Format - Describes the details of the file formatting.

Updating the IQC - Describes the details in updating the IQC system.

Maintenance - Procedures for troubleshooting the IQC. Also lists specifications for IQC and its various configurations.

Appendix 1 Capture & Playback Samples - Case studies and trial procedures.

Appendix 2 IQC Disk Sanitization - Describes procedures and guidelines for securely erasing information from the IQC drives..

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The X-COM IQC-2110 makes it possible for users of Tektronix, Agilent and Rohde and Schwarz Signal Analyzers to increase their signal storage to hours or days. This capability gives users an unprecedented ability to analyze complex, wideband, long duration, and intermittent wave forms. The IQC-2110 can continuously record and play back the full 16 bit I and Q data stream from the RSA6000 signal analyzer with bandwidths up to 110 MHz, up to 80 MHz the Rohde & Schwarz FSW, and up to 40 MHz with the Rohde and Schwarz FSV or Agilent X-Series Signal Analyzers. Signals are stored in a non-proprietary format to allow analysis by a wide range of digital signal processing tools. When combined with an X-COM SigAnalyst workstation and X-COM's Spectro-X software, users have a very powerful turn-key digital signal processing capability. By adding an X-COM CPG (Continuous Playback Generator) and a Vector Signal Generator, users can play back recorded signals with exceptional fidelity.

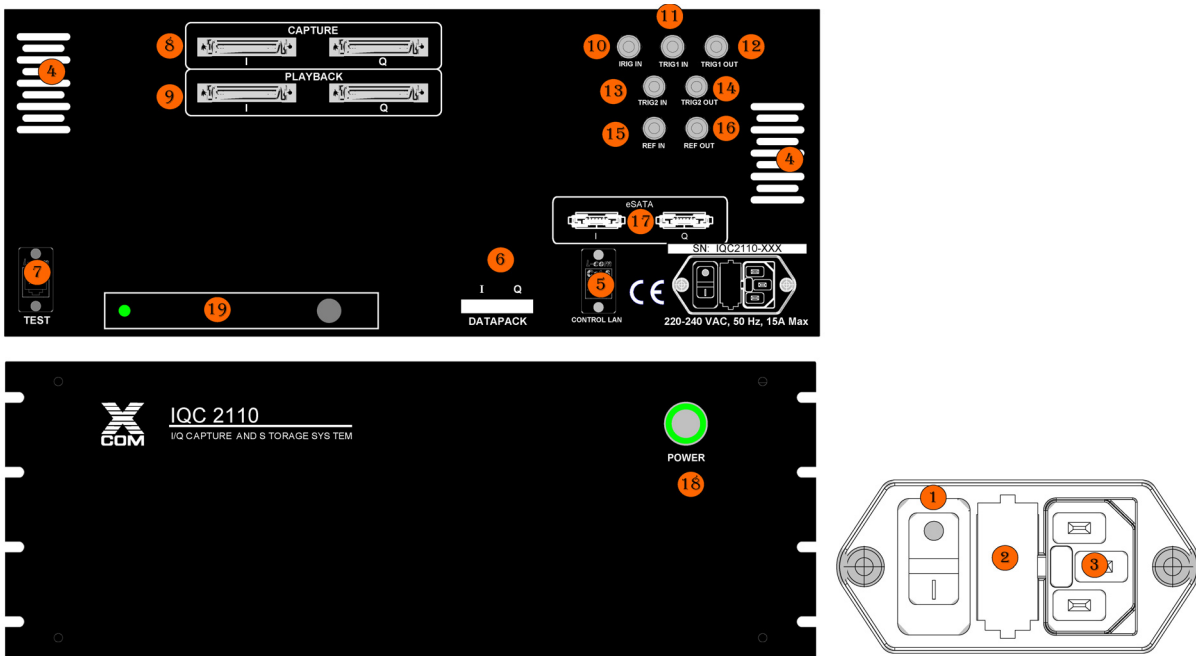
Compatible Signal Analyzers

Vendor	Compatible Signal Analyzer	Supported Spans
Tektronix	All RSA5000 Series with Option 55	10 kHz to 85 MHz, discrete*
	All RSA6000 Series with Option 05	10 kHz to 110 MHz, discrete*
Agilent	PXA - No Options	Up to 10 MHz
	PXA Option B25	Up to 25 MHz
	PXA Option B40 or Option B1X	Up to 40 MHz
	MXA or EXA with Option DP2	Up to 10 MHz
	MXA or EXA with Option B25 + Option DP2	Up to 25 MHz
	MXA or EXA Option B40 + Option MPB	Up to 40 MHz
Rohde & Schwarz	FSW with Option B17 and EX-IQ Box Rev 2.0	Up to 40 MHz
	FSW with Option B17 and EX-IQ Box	Up to 80 MHz

* See "Tektronix RSA6000 Discrete Capture Spans" on page 32.

Connections

IQC 2110



Component	Name
1	AC Disconnect
2	Fuse Drawer
3	AC Input
4	Fan Exhaust port
5	Control LAN
6	Datapack Connect
7	Test LAN
8	I/Q LVDS Digital Capture
9	I/Q LVDS Digital Playback
10	IRIG In
11	TRIG 1 In [*]
12	TRIG 1 Out
13	TRIG 2 In [†]
14	TRIG 2 Out
15	Ref In
16	Ref Out
17	eSATA
18	Power Switch with LED
19	Removable Operating System Drives (Optional)

* Capture on Trigger Input or markers

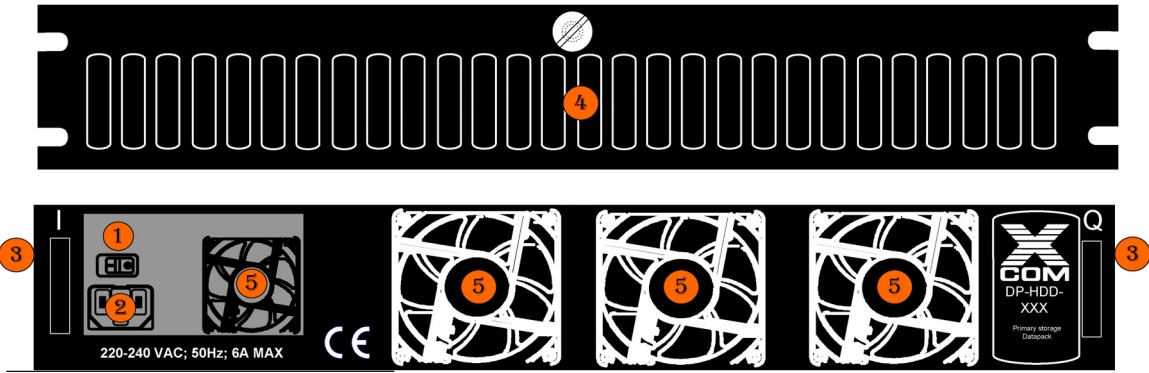
† Markers Input only

CPG-2110



Component	Name
1	Fuse Drawer
2	AC Input
3	I/Q LVDS Input
4	Power Switch with LED
5	I/Q Analog Output

DP-HDD-XXX



Component	Name
1	AC Disconnect
2	AC Input
3	Mini SAS Connectors
4	Air Intake Ports
5	Fan Exhaust Fans

Unpacking and Inspection

WARNING

Heavy load. Do not attempt to lift unaided.

1. Carefully inspect shipping container for signs of damage.
2. Do one of the following:
 - If the shipping container is damaged, do not unpack the unit. Immediately notify the shipping carrier and X-Com Systems at 703-390-1087.
 - If the shipping container is not damaged, unpack the unit.

Note: *Save shipping materials for repackaging.*

3. Inspect unit for visual signs of damage.

Note: *If there is damage, immediately notify the shipping carrier and X-Com Systems.*

Unpacking the Data Pack

1. Open the front cover of the Data Pack.
2. Remove the protective foam insert from the front of the unit.

Note: *Save the protective foam insert for future transportation and/or shipment.*

CAUTION

Always use the protective foam insert when transporting the Data Pack. Otherwise, the drives may become dislodged and damaged in transit.

3. Inspect each drive in the Data Pack by pressing firmly on each individual drive.

Note: *Ensure each drive is not loose and is seated properly into the back plane of the Data Pack. A loose drive will cause the IQC-2110 to not recognize the Data Pack.*

4. Close the front cover of the Data Pack and lock it into place by tightening the knob located on the front cover.

Note: *To repack the Data Pack, reverse this procedure.*

Mounting

CAUTION

Do not block airflow. The air intake vents on the sides and exhaust in the rear of the system must not be obstructed in order to prevent overheating.

Note: For maximum stability, use eight screws to secure the IQC into the rack.

CAUTION

Avoid installing the IQC system near equipment that exhausts or radiates excessive heat (such as power amplifiers or DC power supplies). Proper ventilation should always be considered as part of the installation location.

Note: It is recommended that the rack is properly secured to either a wall or the floor.

1. Install the IQC into the equipment or test rack.
2. Secure the IQC to the rack using the mounting screws.
3. Connect proper power supply. See "Setting up the X-COM IQC-2110 System" on page 7.
4. Connect the IQC to the datapack.

Note: See "Wiring Diagrams" on page 11.

Figure 1 Rack Mount

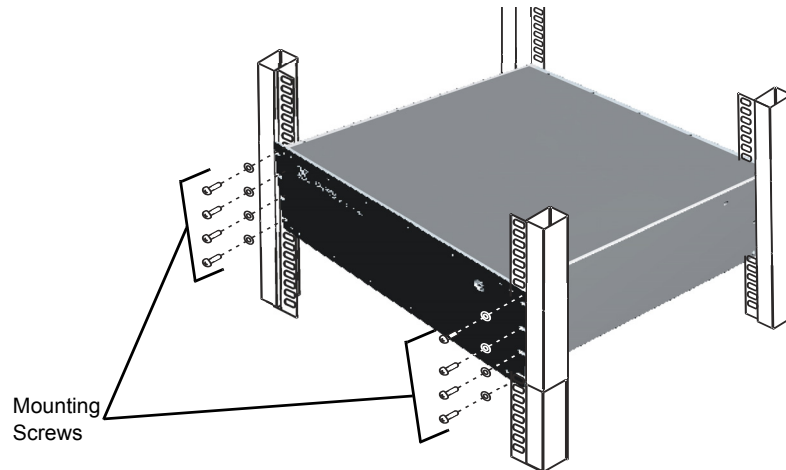
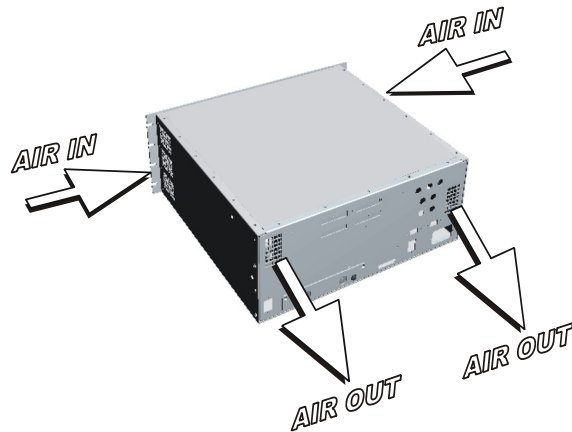


Figure 2 Airflow



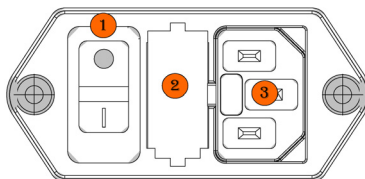
Operating on AC Power

For AC power operation, the IQC, Datapack, and CPG are simply connected to an AC receptacle using the line cord provided. The correct AC voltage is selected via a rear panel switch (Figure 3).

CAUTION

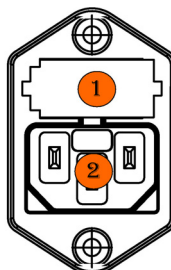
Always be certain the 115/230 voltage selector is set to the proper voltage before AC power is applied.

Figure 3 IQC AC Receptacle



Item No.	Description
1	AC input voltage selector switch
2	Fuse holder
3	AC power cable connector

Figure 4 CPG AC Receptacle



Item No.	Description
1	Fuse holder
2	AC power cable connector

Setting up the X-COM IQC-2110 System

Note: The Datapack and eSATA archive are not hot-swappable – they cannot be connected or disconnected while the power is on. All other connections can.

WARNING

Ensure that the correct cords are used. Only cords with of the proper type with the correct power rating should be used. Otherwise, a potential shock and/or fire hazard may occur.

WARNING

Do not block access to the power cords and connection to the mains. Ensure that the cords are easily accessible in cases of emergency shutdown and quick disconnection.

WARNING

Ensure all power switches are in the off position before applying AC power.

WARNING

Never attempt to connect or disconnect RF equipment from the transmission line while RF power is being applied. Leaking RF energy is a potential health hazard.

Turning on and Connecting the IQC System

1. Connect power cables to the following devices:
 - Signal Analyzer
 - CPG
 - VSG
 - Datapack
 - PC
2. Connect the IQC Datapack cables (external MiniSAS cables) from the back of the IQC chassis to the corresponding Datapack slots marked I and Q – either the top or bottom slot (see Figure 5).
3. Toggle ON the power switch on the back of the Datapack.

Note: Please allow the Datapack to initialize for at least 30 seconds prior to continuing.

Note: The Datapack is not hot-swappable, therefore it should not be powered off and the external MiniSAS cables should not be disconnected unless the IQC Chassis is turned off.
4. Connect the eSata Archive to the IQC.

Note: Perform the following only if the eSata offloading option has been purchased.

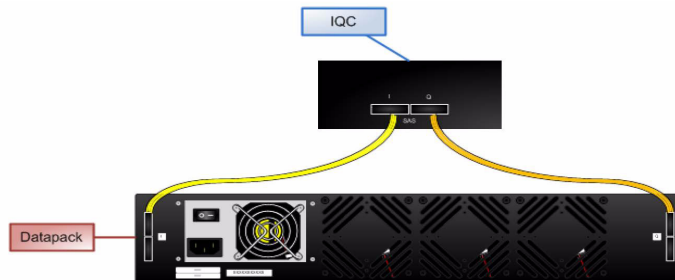
 - a. Connect power to the eSata archive.
 - b. Turn the eSata on.
 - c. Connect the eSata cables to the IQC.

Note: eSata hot-swapping is not supported, so follow the same protocol connecting eSata drives as for connecting a Datapack.
5. Connect the IQC power cable to an AC power outlet.

Note: There is a 15-second timeout before the IQC 2110 can be powered on.
6. Once the timeout is complete, toggle ON the power switch located in the bottom-right corner on the back of the IQC.

Note: After turning on the power switch, the IQC takes approximately 8 seconds to initialize – wait before pressing the LED power button located in the top-right corner on the front of the unit. The IQC Chassis will take approximately 2 minutes to boot, during which time the green power LED on the front of the unit will flash. The system will be ready to capture once this green LED has stopped flashing and is solidly lit. (Likewise, the LED will flash until solidly lit when switching between capture and playback modes.)
7. Connect the following Ethernet cables to an Ethernet switch.
 - The control PCs Ethernet port
 - The port marked **LAN** on the IQC
 - The LAN port of the signal analyzer

Figure 5 Connecting the Datapack



Connecting for Capture

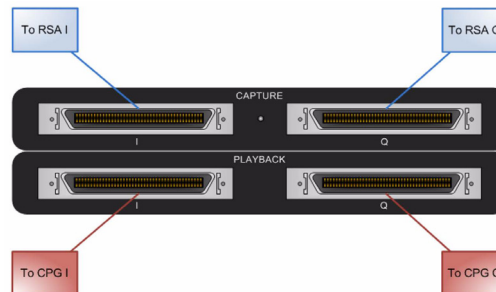
Tektronix RSA

1. Connect the I and Q LVDS cables from the Digital IQ Out (LVDS) ports to the corresponding I and Q ports marked Capture on the back of the IQC Chassis (see Figure 6).

Note: These will be located on the back panel of the RSA, locate the Digital IQ Out (LVDS) ports.

2. Turn on the RSA.

Figure 6 LVDS Ports, IQC Chassis Back – for Tektronix RSA Capture



Agilent X-Series

1. Connect the thinner end of the Agilent LVDS cable to the Capture I port.
2. Connect the wider end to the X-Series Digital OUT port.

Rohde and Schwarz FSV or FSW

1. Mate the RSX adapter box with the EX-IQ Z-Dok connector.
2. Connect the wide LVDS cables from the RSX I and Q to the IQC Capture I and Q (see Figure 5).
3. Connect the smaller LVDS cable from the EX-IQ IN port to the FSV Digital OUT port.
4. Connect a USB cable from the EX-IQ to the FSV.

Connecting for Playback

1. Connect the I and Q cables from the back the CPG to the corresponding I and Q ports marked Playback on the back of the IQC Chassis (see Figure 7).
2. Turn on the CPG.
3. Connect the corresponding I and Q BNC cables from the front of the CPG to the I and Q baseband inputs of the VSG.
4. Use a 50-Ohm BNC cable to connect the reference oscillator OUT from the VSG to the clock IN on the IQC.

Note: An internal reference is recommended when playing back, but is not necessary for capture.

5. If desired, use this procedure to set up an IRIG B type device for time-referencing markers during capture:

- a. Use one of the following IRIG B type devices:
 - IRIG B120, for CF = IEEE-1344
 - IRIG B121, for CF = IEEE-1344
 - IRIG B122
 - IRIG B123
 - b. Connect the IRIG output of the device to the IRIG IN on the IQC-2110 using a 50 Ω BNC cable (see Figure 6).
 - c. The IQC will automatically synchronize with the IRIG device when it is receiving a *locked* signal from the satellites.

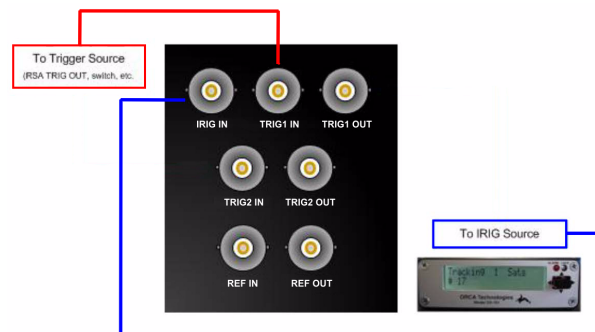
Note: *The time format for IRIG B types is Coordinated Universal Time (UTC).*
6. If desired, use this procedure to set up an external trigger to begin and end one or multiple captures or to mark data during capture with a timestamp:
- Note:** *Markers are useful as reference points for playback, analysis and partial downloading of a captured file.*
- a. Connect an external trigger from an oscilloscope, signal analyzer, or any other device that provides a rising edge TTL level trigger, to the IQC TRIG 1 IN using a BNC cable (see Figure 7).

Note: *If these ports are used to initiate or terminate a capture, it can be done with:*

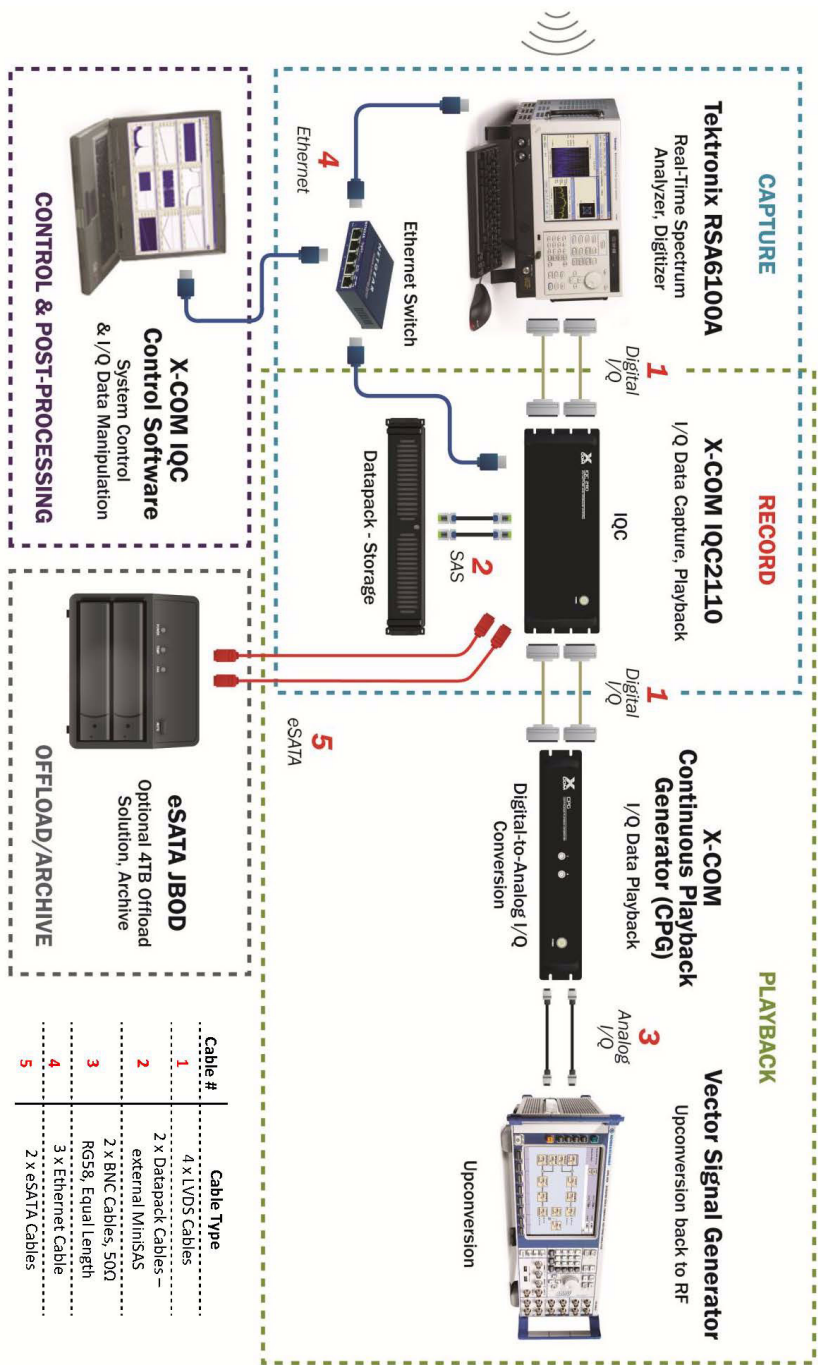
 - *A single pulse's rising and falling edge.*
 - *Successive pulse rising or trailing edges.*
 - *A rising edge of one pulse and the trailing edge of the next.*
 - *A trailing edge of one pulse and the rising edge of the next.*

Note: *If Trig 1 In is being used for Capture on Trigger, Trig 2 In can be used to insert markers into the Capture file.*
 - b. Connect a second triggering device to TRIG 2 IN (optional).
 - c. Set your device(s) to output triggers on desired events and the data will be marked at those samples (see "Inserting Markers during Capture" on page 33).

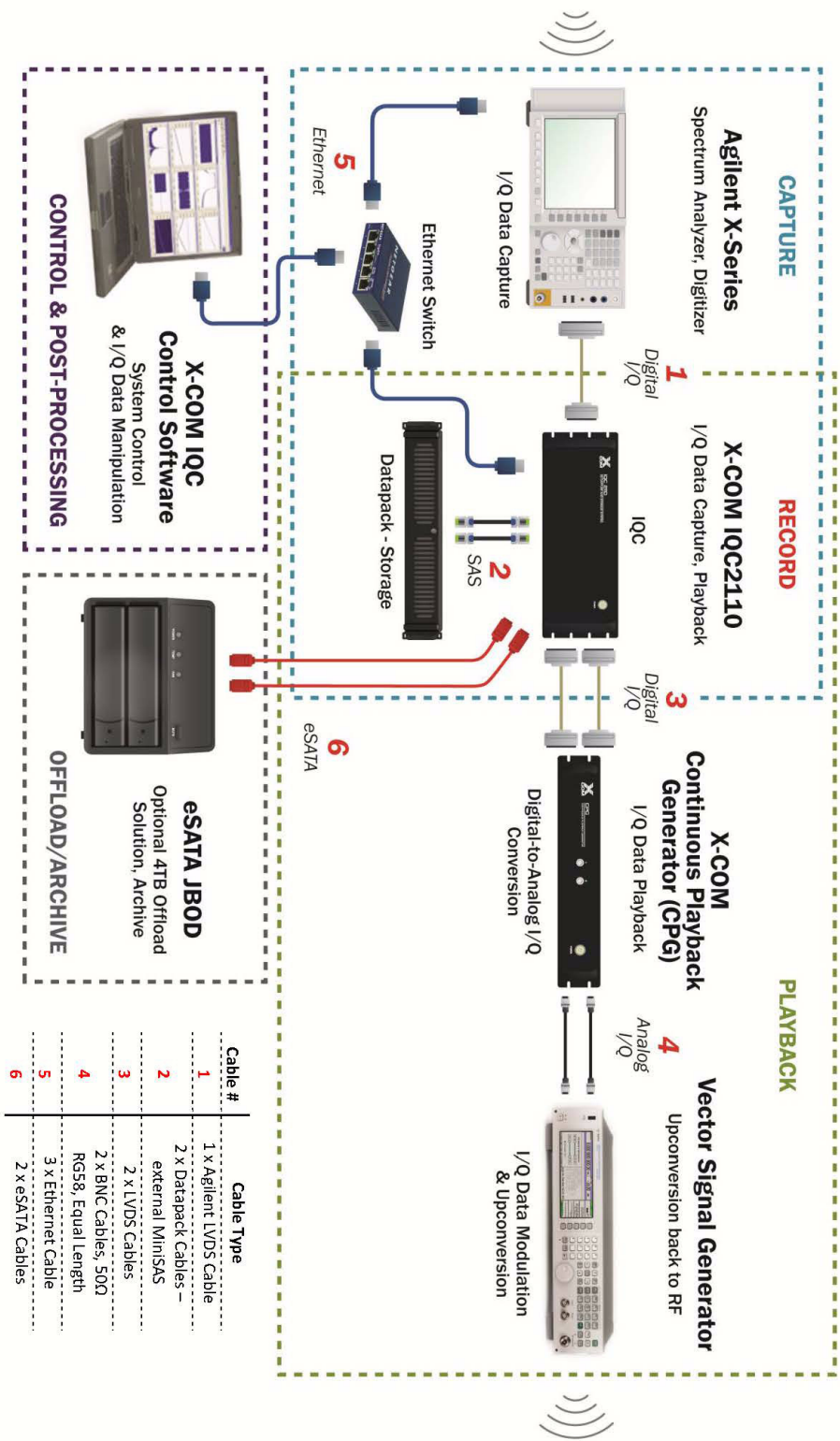
Figure 7 Connections for Marking Data, IQC Chassis Back



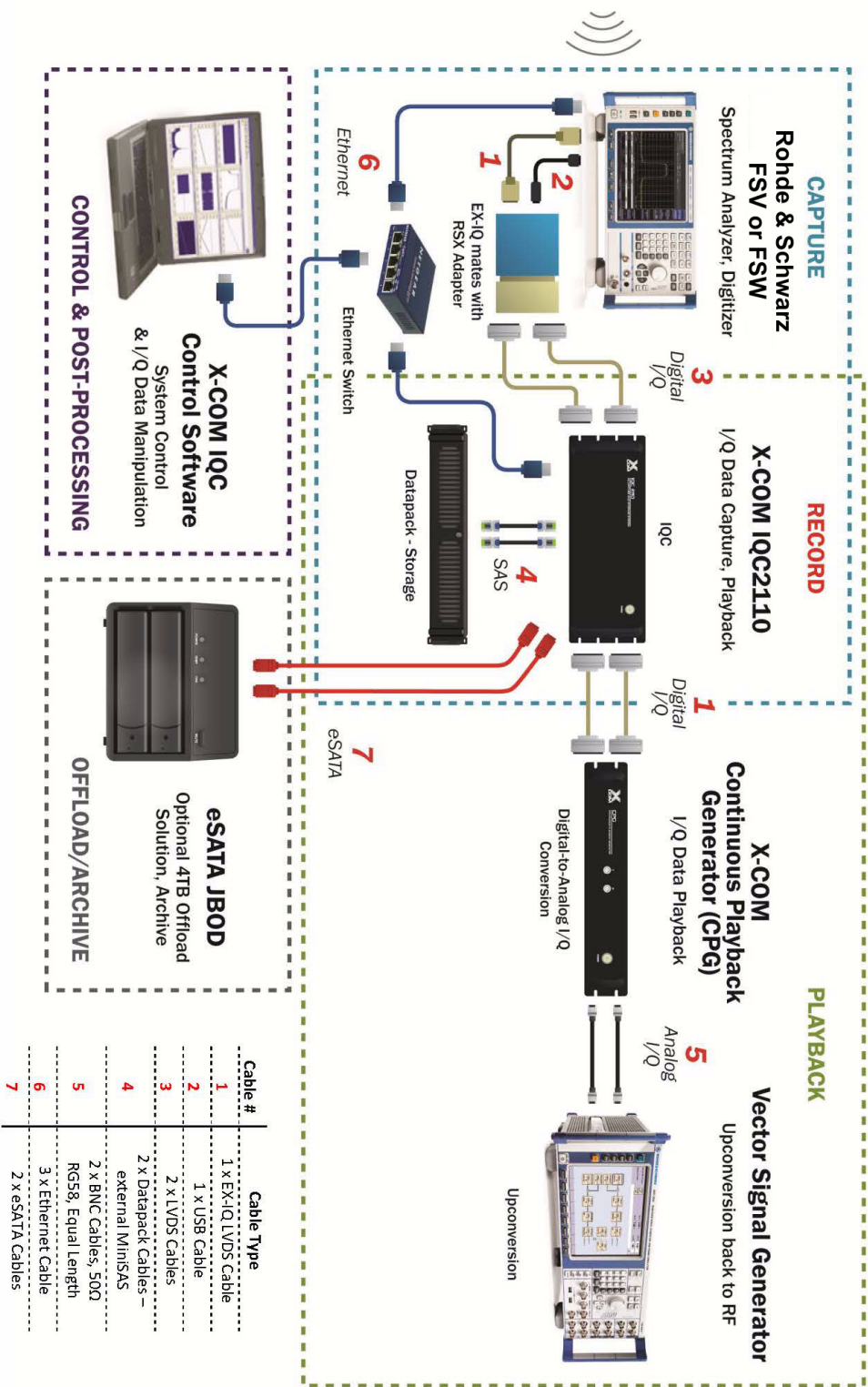
IQC System Wiring Diagram, using the Tektronix RSA6000 or 5000A Series



IQC System Wiring Diagram, using the Agilent X-Series



IQC System Wiring Diagram, using the Rohde and Schwarz FSV or FSW



Setting up the IQC Control Software and Workstation for the First Time

WARNING

Ensure all power switches are in the off position before applying AC power.

1. Install the IQC Control Software on a PC or laptop that will be used to control the IQC.
2. If desired, manually configure the exceptions for three ports in the Windows Firewall by performing the following procedure:

Note: Windows XP, Vista (32 and 64 bit) and 7 (32 and 64 bit) are supported.

- a. Go to Start > Control Panel > Windows Firewall > Exceptions > Add Port.
- b. Add port number 5843 in the port number field, select UDP, and click OK.
- c. Open ports 5844 and 5845 in the same manner, this time choosing TCP as the communication type.

Note: Add exceptions for these ports in any antivirus software that may be running on the control computer.

3. If desired, customize the IQC network setup.

Note: The IQC's default IP address is 192.168.2.200. If the IQC does not need to be changed from the default IP address, skip to XXXXX (e.g.: configured for operation within a LAN of a different subnet).

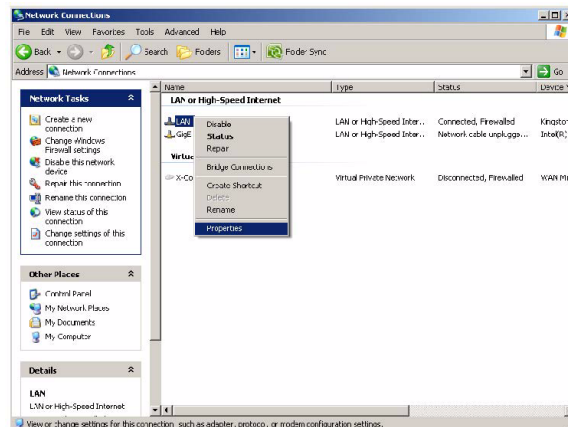
4. Configure the IQC to have a static IP address and used on a LAN with other networked devices by determining the following IQC configuration information:

- IP address the IQC should be set to
- Subnet mask
- Gateway IP address
- DNS IP address

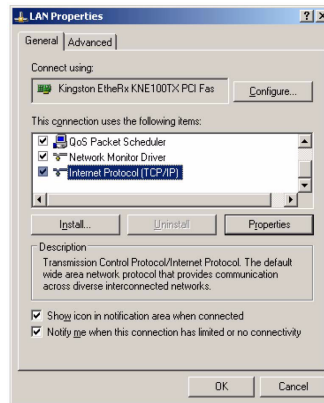
5. Set up the control PC to obtain an IP address and DNS server address automatically.

Example - The following procedure demonstrates how to do this on a Windows XP PC:

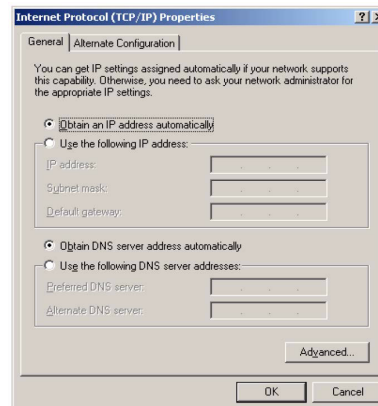
- a. Go to Start > Control Panel > Network Connections.
- b. Right-click on the adapter icon which the IQC is connected to.
- c. Select Properties.



- d. Highlight Internet Protocol and click on the Properties button.

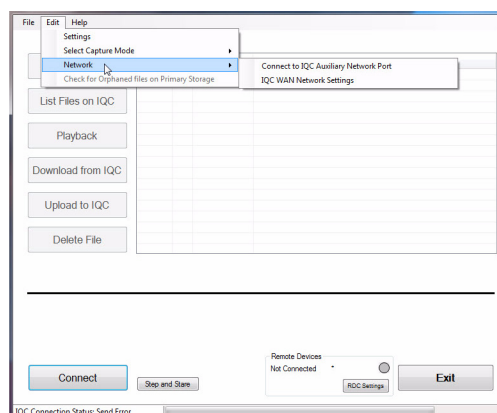


- e. Select both options Obtain an IP address automatically and Obtain DNS server address automatically.
f. Click OK, and then OK on the Connection Properties box.



6. Move the Ethernet cable from the port labeled LAN on the IQC to the port labeled AUX.
7. Ensure that there is a direct connection from the AUX port to the control PC and not through any routers or switches.
8. Launch the IQC Control software.

Note: The IQC Control Software will attempt to connect to the IQC, but fail once it is launched. Please click Cancel when the dialog box appears stating that IQC Control failed to connect.

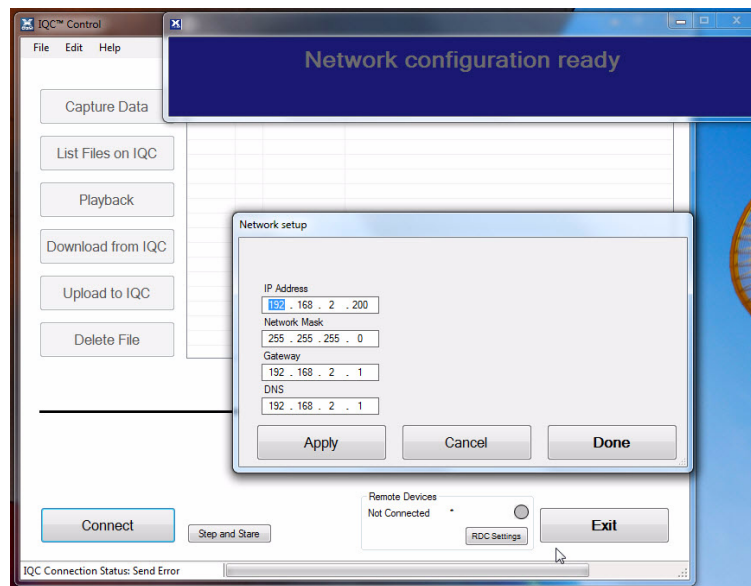


9. Select Edit > Network > Connect to the IQC Auxiliary Network Port within IQC Control.

Note: A return announcing a successful connection should appear. If not, verify that there is a direct connection from the control PC to the AUX port and that DHCP is enabled on the control PC, and then restart IQC Control.

10. Go to Settings> Network> IQC WAN Network Settings within IQC Control.
11. Enter the custom network configuration.
12. Click on Apply, then click Done.

Note: When connecting directly to the IQC, the Gateway and DNS IP addresses can be set to .1 of the same subnet as the IQC's IP address.



13. Set the IP address of the control PC by doing the following:

Note: The IQC has these defaults:

IP Address: 192.168.2.200

Subnet Mask: 255.255.255.0.

- a. Go to **Start > Control Panel > Network Connections**.
- b. Right-click on the adapter icon which the IQC is connected to.
- c. Select **Properties**.
- d. Highlight **Internet Protocol** and click on the **Properties** button.
- e. Select **Use the following IP address**.
- f. Enter the following IP address:
192.168.2.X

Note: Where X = 2 to 254, but not 200 as the IQC and control PC should not be set to the same IP address.

- g. Click OK, and then OK on the Connection Properties box.

14. Move the Ethernet cable back from the port labeled **AUX** to the port labeled **LAN** on the IQC.

Note: The connection may now be made through a switching device, and does not have to be directly connected.

15. Click on the Connect button in IQC Control software.

Note: The IQC Control Software should now be able to connect to the IQC. Once connected, a list of the XIQ files on the Datapack should be listed.

Setting up the Tektronix Real-Time Signal Analyzer

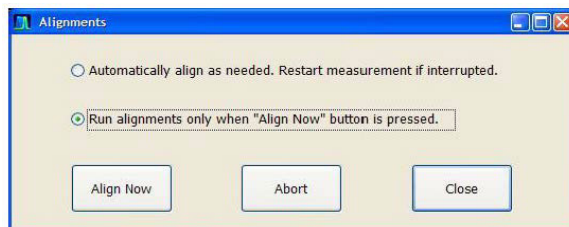
Note: Refer to the Tektronix RSA Operating Manual for more detailed instructions. The following steps are intended to provide a quick setup. A setup file is included with the RSA to expedite setup time. To access it, go to **File>Recall...** in the RSA application and navigate to **Desktop>RSA-Settings**. Open the file **IQC_FRS_CH2.Setup**. Review the following section if you would like to get more familiar with manually setting up the RSA.

1. Press the power button on the bottom left of the unit.
2. Wait for the display to initialize.
3. Set the IP address of the RSA to 192.168.2.32.

Note: Optionally, the IP address of the RSA in Remote Device Control can be changed.

4. Go to Edit > Select Capture Mode > Tektronix.
5. Go to Tools>Alignments.
6. Select the Run alignments only when "Align Now" button is pressed option.
7. Select Align Now to perform alignment.

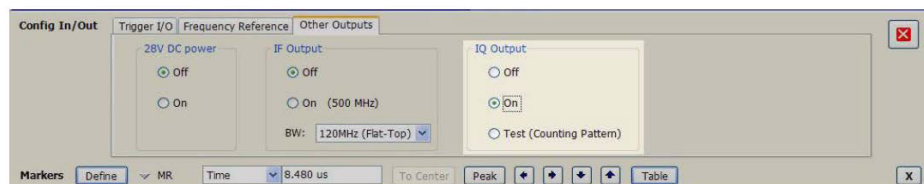
Note: Alignment should be performed after a 20-minute warm-up. The alignment mode should not be set to automatic, else the I/Q streaming data is interrupted by an automatic calibration.



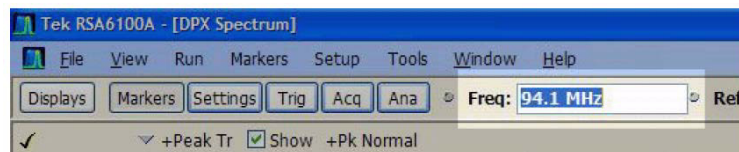
8. Select Setup > Configure IN/OUT.

Note: In order to stream data to the I/Q external connectors, the I/Q output option must be turned on.

9. Go to the Other Outputs tab.
10. Select On under the IQ Output field.



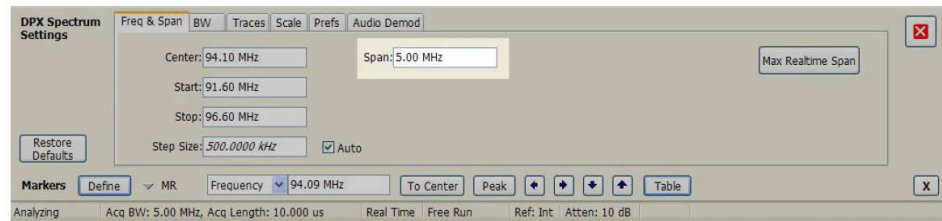
11. Select the Center Frequency adjustment box just below the main toolbar.
12. Enter the frequency value corresponding to the signal of interest.



13. Select the Span adjustment box.

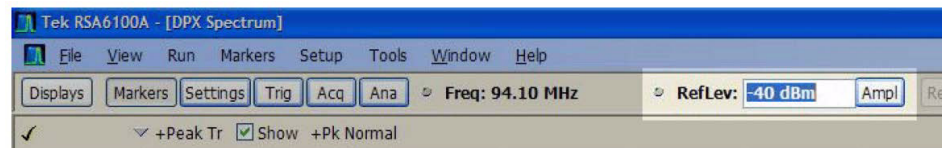
Note: Enter the bandwidth frequency that is wide enough to view the entire signal of interest.

14. Go to Setup > Settings.
15. Adjust the value in the Span text box under the Freq & Span tab.



16. Select the reference level adjustment box just below the main toolbar.
17. Set it to the desired level to view the signal.

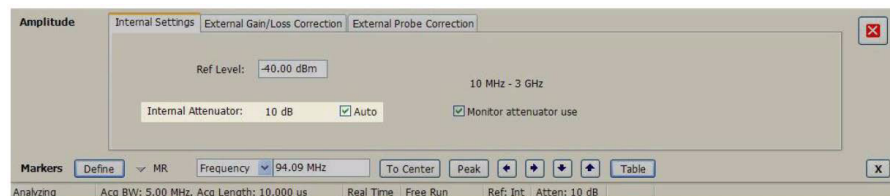
Note: Signal strength should not go beyond the range of the RSA, as this can damage internal components.



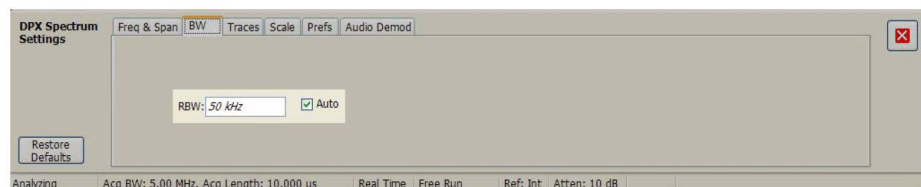
18. Go to Setup > Amplitude.

Note: In many cases, the attenuation can be set automatically by the instrument. For optimum recording, the attenuation should be set manually to a level that does not overdrive the A/D circuitry.

19. Adjust the Internal Attenuator manually or automatically under the Internal Settings tab.

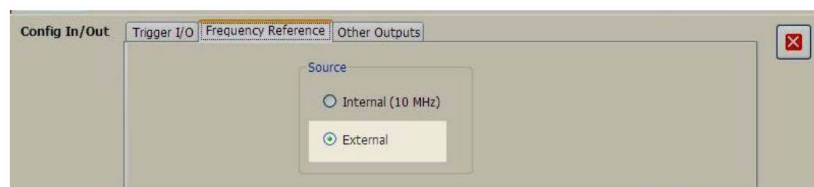


20. Go to Setup > Settings.
21. Select the BW tab.
22. Adjust the resolution bandwidth in the RBW textbox.



23. Go to Setup > Configure In/Out.
24. Select the Frequency Reference tab. Select the External radio button.

Note: Recommended for use when playing back into the RSA from the VSG.



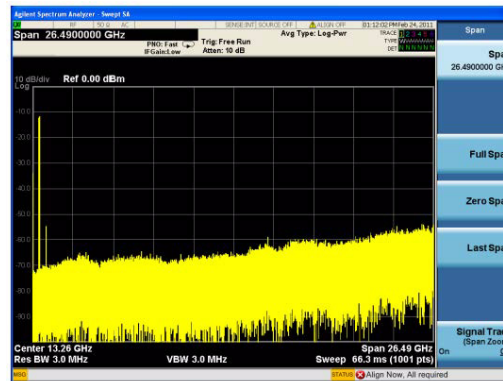
Setting up the Agilent X-Series Signal Analyzer

Note: Refer to the X-Series Operating Manual for more detailed instructions on signal analyzer operation. The following represents the minimum steps required to perform capture with the IQC. Button presses and SCPI commands are provided for each step. The following notation is used:

b_ = Button on front panel

SCPI command (optionally, for remote control)

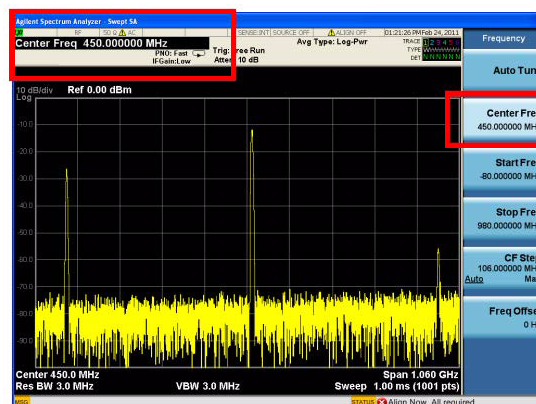
1. Press the power button on the bottom-left of the signal analyzer.
2. Wait for the display to initialize, and the unit to calibrate.



3. Once the SA is up, log off user Instrument.
4. Log on:
Name: *administrator* (no caps)
Password: *agilent4u*.
5. Change the IP address to:
192.168.2.220.

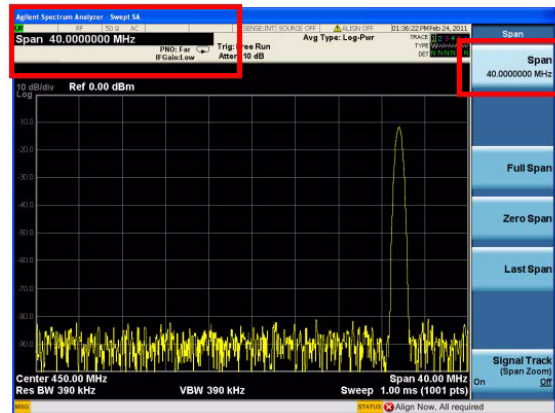
Note: Optionally, the IP address of the SA can be changed in Remote Device Control. See "Remote Device Settings" on page 25.

6. Go to Edit > Select Capture Mode > Agilent.
7. Adjust the Center Frequency to a signal of interest.
b_FREQ XYHz
FREQ:CENT XYHz



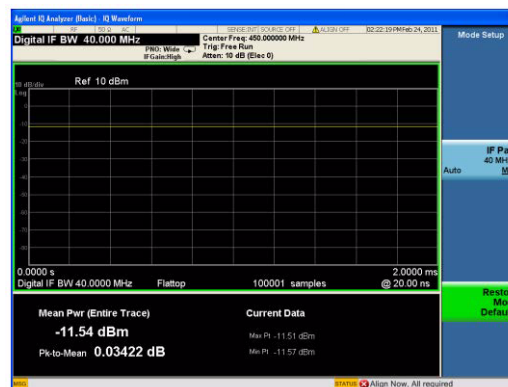
8. Adjust the Capture Span to include the signal.
b_SPAN XYHz
WAV:DIF:BAND XYHz

Note: A max span of 40 MHz is supported.



9. Click the Capture button in IQC Control.

Note: The SA will configure to capture mode.



10. Adjust Amplitude, Attenuation, and IF Gain in IQC Control.
11. Update the SA.

Note: To modify the settings on the SA, click Update IQC in capture control to update the capture file settings on the IQC. Alternatively, change the settings in capture control and click Update SA.

Setting up the Rohde and Schwarz FSV Signal Analyzer

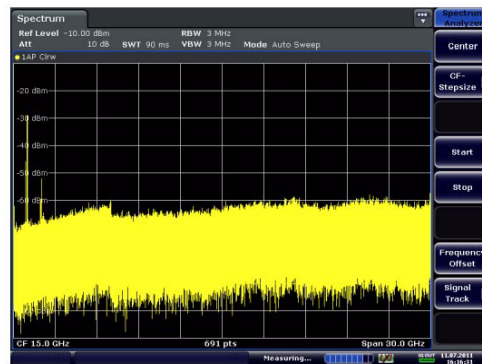
Note: Refer to the FSV Operating Manual for more detailed instructions on FSV operation. The following represents the minimum steps required to perform capture with the IQC. Button presses and SCPI commands are provided for each step. The following notation is used:

b_ = Button on front panel

s_ = Softkey on display

SCPI command (optionally, for remote control)

1. Press the power button on the bottom-left of the FSV.
2. Wait for the display to initialize, and the unit to calibrate.



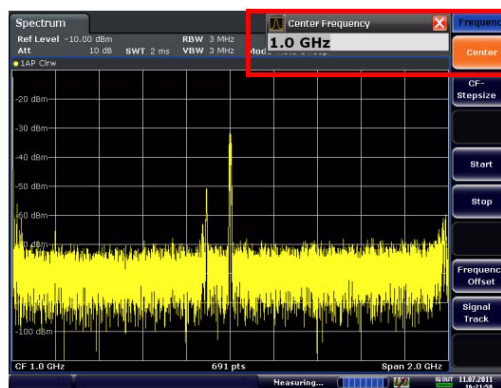
3. Set the IP address of the FSV to 192.168.2.110.

Note: Optionally, the IP address of the FSV in Remote Device Control can be changed.

4. Go to *Edit > Select Capture Mode > Rohde & Schwarz*.
5. Adjust the Center Frequency to a signal of interest.

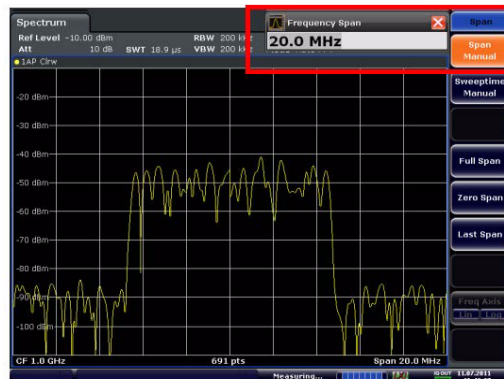
b_FREQ XYHz

SENS:FREQ:CENT XYHz



6. Adjust the Capture Span to include the signal.
b_SPAN XYHz
FREQ:SPAN XYHz

Note: A max span of 40 MHz is supported.



7. Adjust Pre-Amp, RF Attenuation to suit.
b_AMPL > s_Pre-Amp ON
INP:GAIN:STAT ON

b_AMPL > s_RF Attenuation 0
INP:ATT X

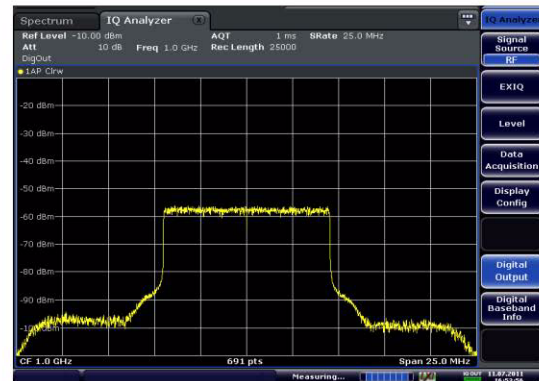


8. Click the *Capture* button in IQC Control.

Note: The FSV will configure to capture mode.



While configuring, the FSV display will blank.



IQ Analyzer mode (digital streaming capture mode)

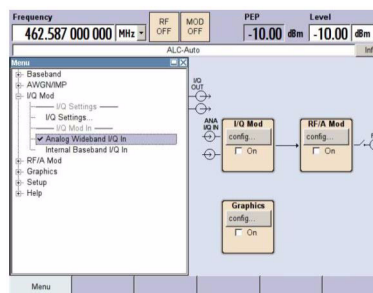
Note: To further adjust settings on the FSV, press *s_Local* to enable the touchscreen and modify settings, then click *Update IQC* in capture control to update the capture file settings on the IQC. Alternatively, change the settings in capture control and click *Update FSV*.

Setting up the R&S SMBV Vector Signal Generator

Note: Refer to the VSG Operating Manual for more detailed instructions. The following represents the minimum steps required to perform RF playback.

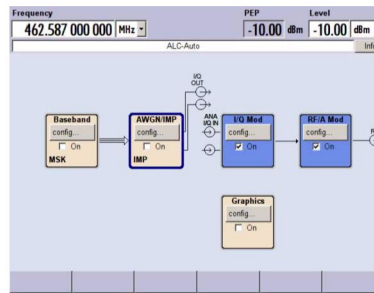
Note: A setup file is included with the VSG to help get you started. To access it, press the *Setup* key on the VSG front panel and scroll down to *Save/Recall...* under the *System* header. (Using a USB mouse makes navigation much easier.) Make sure that *Recall* appears in the drop-down menu, select the file *SMBVSetup*, and click on the *Recall* button at the bottom of the menu. Review the following section if you would like to know how to manually set up the VSG.

1. Press the power button located on the bottom-left of the unit.
2. Wait for the display to initialize.
3. Press the Menu button.
4. Click on I/Q Mod.
5. Scroll down to and select Analog Wideband I/Q In under the I/Q Mod In header.



6. Enter the center frequency which corresponds to the original RF frequency captured by the RSA.

- Set the desired output level by entering the appropriate dBm value.



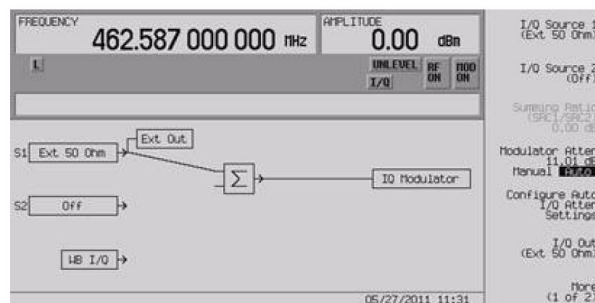
- Press the Mod Off and RF Off buttons to initiate RF output.

Note: It is important to make sure that the last two blocks – I/Q Mod and RF/A Mod – are blue (activated), and that RF Off and Mod Off boxes do not appear at the top of the screen. The first two blocks in the diagram correspond to internal generation of signals (and are not generally used for IQC playback); the last two correspond to input and modulation.

Setting up the Agilent PSG Vector Signal Generator

Refer to the PSG Operating Manual for more detailed instructions. The following represents the minimum steps required to perform RF playback.

- Press the power button on the bottom-left of the unit.
- Wait for the display to initialize.
- Press the **I/Q** button on the front panel of the PSG.
- Set **I/Q Mode** ON, and **I/Q Path** to **Normal (Mux Source)** using the buttons to the right of the LCD screen to select the proper options.
- Press the **Amplitude** button.
- Turn **ALC** ON.
- Press the **Mux** button on the front panel of the PSG.
- Select **IQ Source**.
- Select **Ext 50 Ohm** in the next submenu.
- If the correct settings have been applied, the screen should now look like this:



- Press the **Frequency** button on the front panel of the PSG.
- Enter the center frequency which corresponds to the original RF frequency captured by the RSA.
- Press the **Amplitude** button on the front panel of the PSG.
- Set the desired output level by entering the appropriate dBm value.
- Press the **Mod On/Off** and **RF On/Off** buttons to initiate RF output.

WARNING

Do not operate with the panel removed. Doing so could result in personal injury.

Using the IQC Control Software

IQC Control is a remote control interface into the operations of the IQC System. This interface controls capture, playback, and file management on the IQC System.

When the IQC Control panel is opened, it connects to the IQC System automatically. A dialog box will appear confirming a successful connection, and the **Connect/Disconnect** button will read **Disconnect**

IQC File Listing

Files stored on the Datapack are listed in the IQC Control panel. The file listing includes the file's name, size, modification date, and protection status. The protection status helps prevent accidental deletion by disabling the Delete File button. Each file captured through the IQC System contains an IQC file header. The header is used to store information, such as a file's span, frequency, markers, and protection status. If a file is uploaded that does not contain an XIQ header, protection and other automated features will not be available. See Figure 8 on page 26.

Remote Device Settings

Remote Device Status (SA or VSG) connections to either an SA or VSG for capture or playback are visible at the bottom of the IQC Control window. Can be changed by left-clicking on the RDC Settings button. See Detail "B" in Figure 8 on page 26.

Connecting an SA or VSG

1. Select the SA or VSG to be used from the pull down menus.
2. Ensure the device IP address to be used is in the same subnet as the IQC (default is 192.160.2.xxx).

Note: The Remote Device Control window will open. See Detail "B" in Figure 8 on page 26.

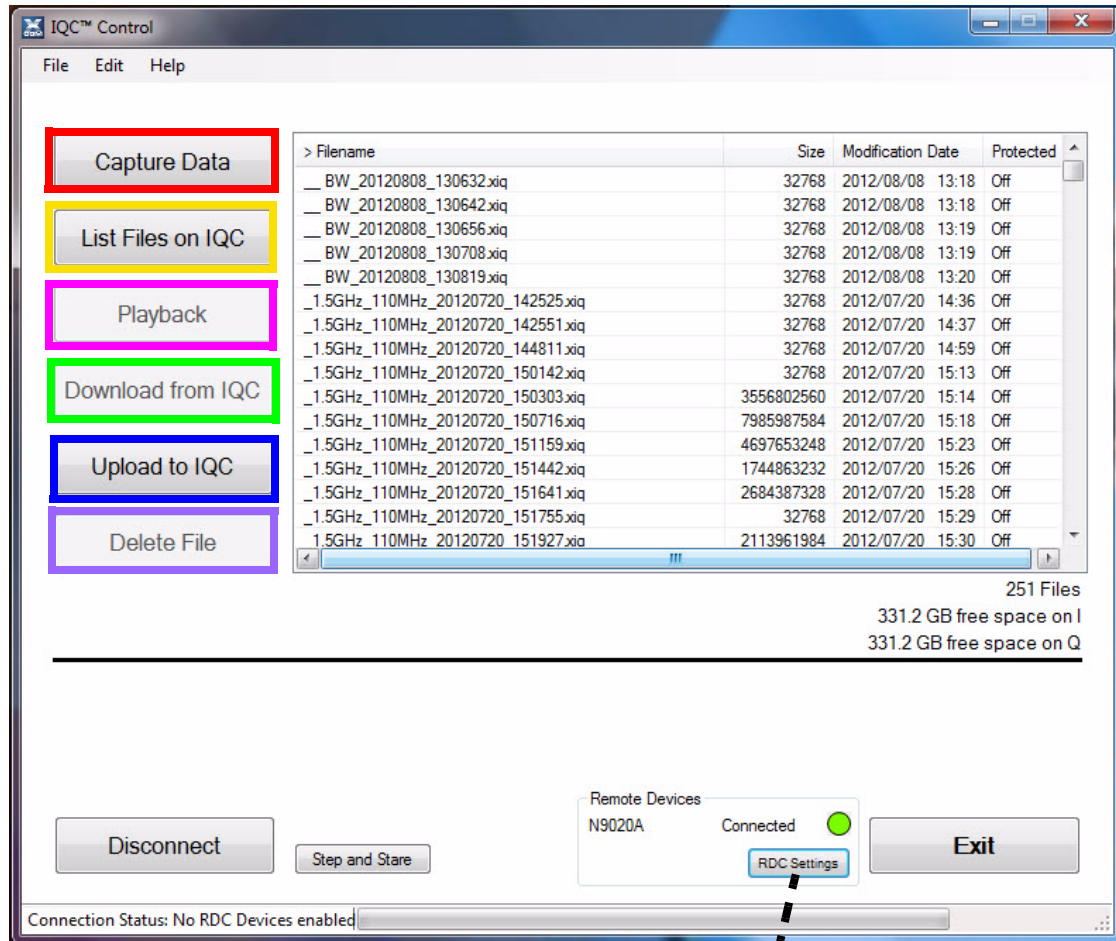
3. Left Click the Connect button.

Note: When the statues bar indicator turns green, the IQC and device are properly connected and ready to use.

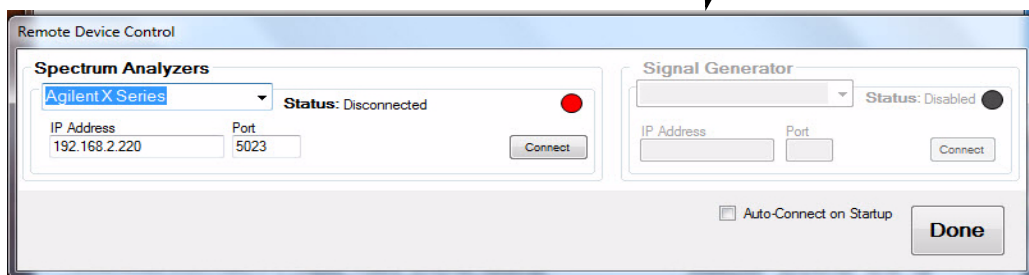
Figure 8 Main IQC Control

Note: Refer to Table 4-1, page 27 for function descriptions.

DETAIL A



DETAIL B



Note: The user must first select the Capture Mode and device via the Remote Device Control window (Detail "B") which is opened by left clicking on the RDC Setting button.

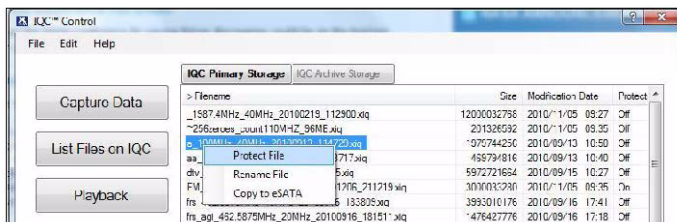
Table 4-1 IQC Functions

Capture Data	Sets the IQC to capture mode and opens the Capture Control Panel.
List Files on IQC	Refreshes the list of files stored on the IQC.
Playback	Sets the IQC to playback mode and opens the Playback Control Panel.
Download from IQC	Copies the selected file to the IQC Control client PC. The default location is C:\IQCFiles; this may be changed by accessing Edit > Settings > Directories .
Upload to IQC	Copies a file from the client PC to the IQC. A dialog box then prompts the user to select the / file to be uploaded. The corresponding Q file is automatically uploaded after the / file completes copying.
Delete File(s)	Deletes the selected file from the IQC storage. This button is disabled for files that have been protected.
Connection Status	Provides feedback during connection attempts to the IQC.
Device Control Indicators	On systems with the Remote Device Control option, device control buttons appear in the lower-right corner of the IQC Control panel for each enabled device. Red indicates that the device is enabled for use, but is not connected. Gray indicates that the device is enabled, but is marked as offline. Green indicates that the device is enabled, connected, and ready for use. To enable or disable a device, click on RDC settings to bring up the Remote Device Control Window (Detail “B” in Figure 8 on page 26), pull down the Signal Analyzer Menu at the top left, select the desired SA and press the Connect button. A Series of Status message will appear with the final status as “Connected”. Note: At any time, the user may disconnect from, connect to, or change the Signal Analyzer in use via the RDC Settings button at the bottom the IQC Control main window.

File Control Functions

The *Primary Storage* and *Archive Storage* tabs are only visible above the file listing when an eSATA archive is attached – otherwise, the primary storage list is always shown. It is possible to protect a file, rename a file, and check for orphaned files during any use – eSATA options are only available when an eSATA archive is attached.

Figure 9 Primary Storage List



Primary Storage List

Protect File – Sets the protect flag in the file’s header so the *Delete File* button is disabled when the file is selected.

Rename File – Rename the selected file.

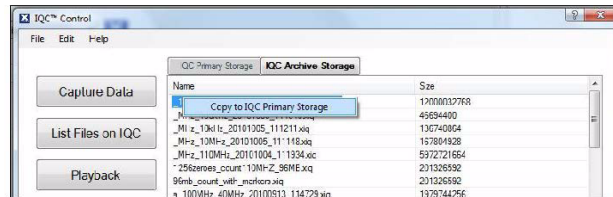
Copy to eSata – Copies both the I and Q files to the attached eSata archive storage unit.

Note: This command is only available when an eSata archive is attached.

Archive Storage List (eSATA)

Note: This command is only available when an eSata archive is attached.

Figure 10 Archive Storage List (eSATA)



Right-click on a file in the list to access these functions:

Copy to IQC Primary Storage – Copies both the I and Q files to the Primary storage (Datapack).

Check for Orphaned files on Primary Storage Menu

The Orphan menu can be accessed under the **Edit** toolbar menu while connected to the IQC. This feature will list any file that does not have a matching I or Q file. By selecting a file in the list, you can *delete* or *rename* it by right-clicking on the file.

Settings Menu

The Settings menu can be accessed under the **Edit** toolbar menu.

Misc Tab Settings

Turn Off IQC – Turns off the IQC.

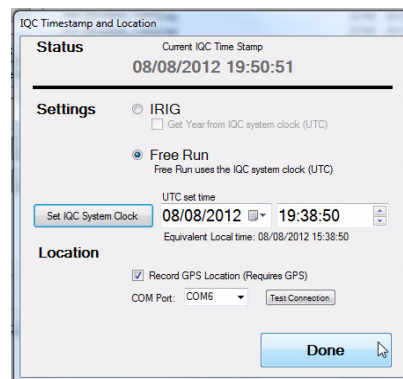
Restart IQC – Restarts the IQC

Config Devices – Sets options for Device Control.

IQC Time – Choose to use an external IRIG-B source or Free Run (IQC local system time) when making timestamped captures.

Note: All time is displayed in UTC. The IQC system time can be set here according to the system time on the control PC by selecting Set IQC System Clock.

Figure 11 IQC Time



Location

The user may connect the RS-232 output port of an external GPS receiver (user supplied) to the comm port of the PC running IQC Control.

1. Connect the GPS to the RS-232 port on the IQC.
2. Turn on the GPS.
3. Wait for confirmation of satellite lock.
4. Click on Record GPS Location (Requires GPS).

Note: An ASCII flat file is opened in the same directory with the same file name as the capture file.

During the capture, once every second, the following will be written into this file:

- Latitude
- Longitude
- Altitude
- TOD

In this way, spectrum data can be time correlated with the GPS file for go-location purposes.

IQ Swap

A user may find a situation where a spectrum they desire to record has been inverted during an up or down conversion process. This feature swaps the I & Q channels coming from the SA used as the RF front end and digitizer. The I channel is stored in the Q file and vice versa.

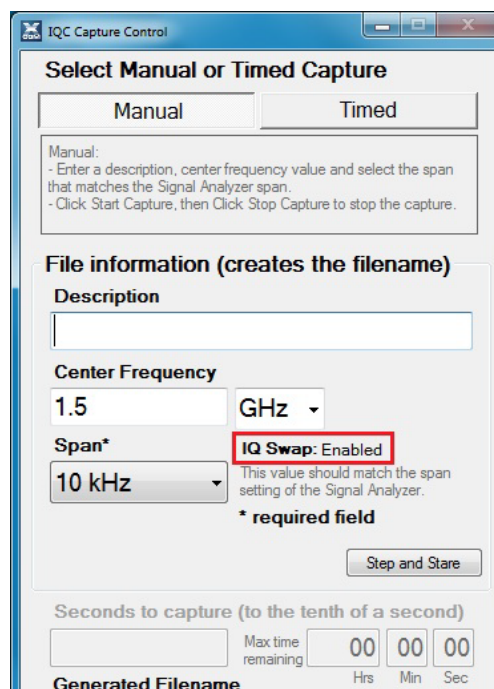
Click on the checkbox to enable IQ Swap.

Figure 12 IQ Swap



The status of the IQ Swap can be seen in IQC Capture Control.

Figure 13 IQ Swap Status



TCP/IP Tab Settings

IQC IP Address – Sets the IQC IP address. The option to ping an IP address is available in this control.

Directories Tab Settings

Transfer Directory – Sets the control PC destination for downloaded files.

Help Menu

The Help menu shows all software and firmware versions. Upgrade the software and firmware here. See “Updating the IQC” on page 41.

Figure 14 About IQC



Capture Data

Starting and stopping captures takes place in the Capture Control Panel. Several settings dictate the filename of the captured file:

- 12-character user-input description
- Center frequency of the signal
- Span of the data output from the SA
- Timestamp automatically placed by IQC Control

The IQC detects the sampling rate from the SA and automatically sets the span, though the center frequency will not populate unless the user has enabled device control for the SA (see “Remote Device Settings” on page 25). If no data is detected, a warning notifies the user. In this case, the user should check that the SA is configured correctly and that all cables are in place. Settings can be updated either by changing them in capture control, or from the SA, if RDC is enabled.

Figure 15 Tektronix (no RDC) Capture Control

Manual or Timed Capture

Manual capture is the default capture mode. Simply start and stop the capture as desired. To switch to a timed capture, click on the **Timed** button. This will enable the **Seconds to Capture** field. The amount of time to capture can be specified to the tenth of a second. A timed capture may be interrupted at any time, like a manual capture. When enabling the timed capture capability, a conservative estimate of the amount of memory left in the Datapack for that span is shown. The amount of time will vary for each span; there will be a greater maximum time for lower spans, and a lesser maximum time for higher spans.

Max Meter

The **Max Meter** is a visual gauge the of signal strength upon capture. This control reflects the digitizer's output values in a scale-like format. An output in the lower yellow region is likely too low for a good capture, and an output in the upper yellow and red regions are likely over-ranging the RSA's digitizer and clipping the signal. Aim for an output near 3/4 full-scale, as shown in the above figure.

Capture Spans

The **Capture Span** or **Capture Bandwidth** refers to the instantaneous bandwidth that will be recorded. With a center frequency at 400 MHz, a 10 MHz capture span would capture all signals ± 5 MHz from 400 MHz (395 to 405 MHz).

Agilent and Rohde captures can be set to an arbitrary span up to 40 MHz with 1 Hz resolution. Tektronix RSA captures are set to discrete spans according to set sample rates. See table below.

Table 4-2 Tektronix RSA6000 Discrete Capture Spans

RSA Span (Hz)	I/Q Sampling Rate (Sps)	Data Rate (Bytes/s)
110,000,000.00	150,000,000	600,000,000
60,000,000.00	75,000,000	300,000,000
40,000,000.00	50,000,000	200,000,000
20,000,000.00	25,000,000	100,000,000
10,000,000.00	12,500,000	50,000,000
5,000,000.00	6,250,000	25,000,000
2,000,000.00	3,125,000	12,500,000
1,000,000.00	1,562,500	6,250,000
500,000.00	781,250	3,125,000
200,000.00	390,625	1,562,500
100,000.00	195312.5	781,250
50,000.00	97656.25	390,625
20,000.00	48828.125	195,313
10,000.00	24414.0625	97656.25

Table 4-3 Tektronix RSA5000 Discrete Capture Spans

RSA Span (Hz)	I/Q Sampling Rate (Sps)	Data Rate (Bytes/s)
85,000,000.00	150,000,000	600,000,000
40,000,000.00	75,000,000	300,000,000
25,000,000.00	50,000,000	200,000,000
20,000,000.00	25,000,000	100,000,000
10,000,000.00	12,500,000	50,000,000
5,000,000.00	6,250,000	25,000,000
2,000,000.00	3,125,000	12,500,000
1,000,000.00	1,562,500	6,250,000
500,000.00	781,250	3,125,000
200,000.00	390,625	1,562,500
100,000.00	195312.5	781,250
50,000.00	97656.25	390,625
20,000.00	48828.125	195,313
10,000.00	24414.0625	97656.25

Inserting Markers during Capture

What Is a Marker?

A *marker* contains the date and time information for a particular sample point when a trigger is issued to the IQC (factoring the propagation delay of the RSA/IQC system at about 140 nanoseconds). Markers are like a bookmark with a time reference – they are especially useful as reference points for playback, analysis and partial downloading of a captured file.

Marker data is contained in the XIQ header of each capture. You can capture up to 509 trigger events to mark each capture, excluding the beginning and end markers (511 total). The first markers do not get overwritten when there are more than 509 triggers; no more markers are captured after 509 triggers. Beginning and end markers will always mark a capture, regardless of trigger stimulus. The end marker is always reserved for the timestamp at the end of the capture. See section *IQC File Format .XIQ*, Field 13 *Markers* for specific details on the format of the timestamp information in the captured file.

How to Insert Markers

To use this feature, connect an external trigger from an oscilloscope, signal analyzer, or any other device that provides a rising edge TTL level trigger, to the IQC TRIG 1 IN using a BNC cable (see Figure 3). You may also connect a second triggering device to TRIG 2 IN. Set your device(s) to output triggers on desired events and the data will be marked at those samples. Note that X-COM software RF Editor can artificially insert markers into a capture.

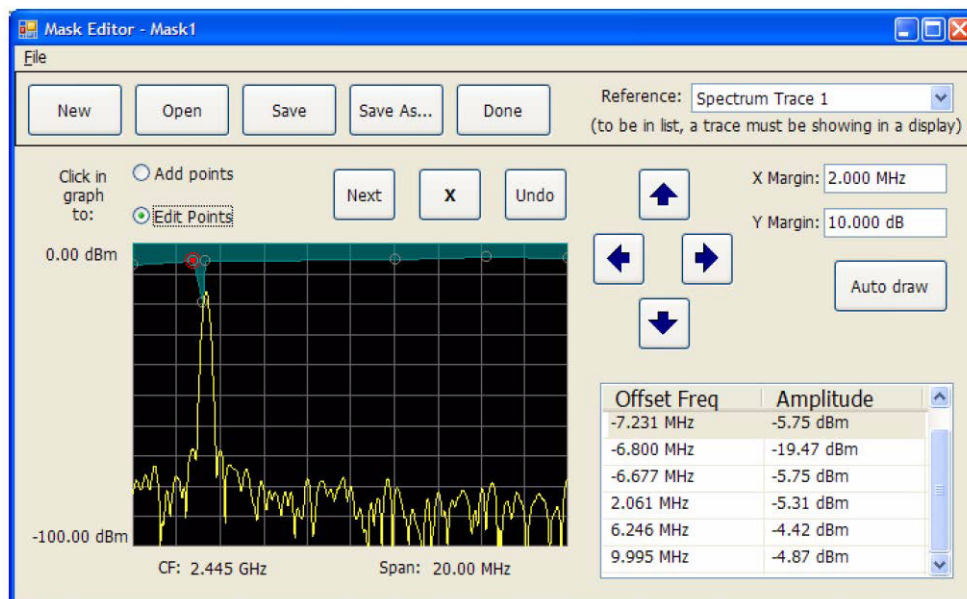
The Usefulness of Marked Data

Suppose that you are trying to capture a signal that appears intermittently, only once every 10 minutes. If you know generally where the signal appears, you can set an RSA mask trigger to trigger when the amplitude of the signal breaches a certain threshold. After you stop the capture, you can now see what time the signal appeared. Furthermore, you can choose to download only a portion of the large file to analyze the data – you can even offset the download to include an amount of time before the trigger was issued. Playback with markers works similarly.

Triggers can also manually be sent through the RSA or other triggering device. If a signal appears as you are watching the DPX display of the RSA, you can force a trigger at that time.

Windowing with markers – marking a signal as it appears and disappears – can be done with the RSA mask trigger by setting it to issue a trigger when the power threshold is breached, and when the signal goes back below that threshold (False > True > False) – or any similar combination (True > False > True).

Figure 16 Setting a Mask Trigger on the RSA



Playback Control

After selecting the file to play back and clicking the Playback button in IQC Control, the Playback Control Panel will open and display the filename of the selected file.

The original span that was used to record the data will automatically be selected to ensure the proper playback, though a different span may be selected. Changing the playback span will affect the length of playback: selecting a larger span will shorten the length of playback, and selecting a smaller span will increase the length of playback.

Figure 17 Playback Control

File Playback

Filename
FRS_CH2_462.587MHz_28MHz_20090910_145023.xiq

Span
40 MHz

☐ Repeat
2

☐ Partial Playback
0
Start - 0 to 11.40595

11.40851
End - Maximum is 11.40851

A start of 7.2 and end of 10.3 will play 3.1 seconds.

Start Playback Done

Repeated Playback

The file may be repeated by selecting the **Repeat** checkbox and inputting the amount of times to repeat the file. There is no limit to the amount of times the file may be repeated. The repeat function can be used in conjunction with partial playback to repeat any portion of the file. This allows the flexibility to create a variety of playback scenarios.

Partial Playback

Playing back select portions of a file is possible by selecting the **Partial Playback** checkbox. This will enable fields to enter the start and end times in seconds. Playback and capture are handled in blocks of 256 samples, so the time resolution can be narrowed to the microseconds in most cases.

Figure 18 Partial Playback

File Playback

Filename
IRIG_511Ttrigger_MHz_10MHz_20091113_154945.xiq

Span
10 MHz

☐ Repeat
2

☒ Partial Playback
11/13/2009-20:53:56.5017480
Start Marker

☒ Use Markers
Last Sample
End Marker

0
Start Offset

0
End Offset

0
Start - 0 to 13.41153

13.4217728
End - Maximum is 13.42177

A start of 7.2 and end of 10.3 will play 3.1 seconds.

Start Playback Done

Playback with Markers

Select the Use Markers checkbox to enable the use of capture markers as playback reference. Every capture contains a beginning and end marker, displayed by default when the Use Markers checkbox is selected; any other markers are user-implemented during capture. Use the Start Marker and End Marker drop-down lists to select the appropriate markers to begin and end playback. The Offset text boxes may then be used to add or subtract time from playback referenced by either the Start or End Marker.

File Download Control

After selecting the file to download and clicking the Download button in IQC Control, the File Download from IQC Control Panel will open and display the filename of the selected file. This panel functions much like the Playback control panel. The original span that was used to record the data will automatically be selected to ensure the proper duration of the file, but the span may be manually changed. This will affect all download operations, so it isn't advised to change this setting. Select the Download I File and Download Q File checkboxes to download both the I and Q portions of the capture. Alternatively, only the I or Q file may be downloaded. The default control PC download location is C:\IQCFiles; this may be changed by accessing Edit > Settings > Directories.

Figure 19 File Download Control

File Download from IQC

IRIG_511Trigger_MHz_10MHz_20091113_154945.xiq

☒ Download I File

☒ Download Q File

☒ Transfer Partial File

☐ Use Markers

10 MHz

Span: 0

Start - 0 to 13.41153

End - Maximum is 13.42177

A start of 7.2 and end of 10.3 will transfer 3.1 seconds.

Start Transfer

Cancel

Partial File Transfer

Downloading select portions of a file is possible by selecting the Transfer Partial File checkbox. It is helpful to download only a portion of a very large capture to analyze a specific section of data. Specify the section of the file in seconds to download, or use markers and marker offsets to download select portions. Downloading only select portions of a file by using markers is an efficient way to skip “wading through” insignificant data. Note that a partial file download will change the begin and end time of the file in the header.

Figure 20 Partial File Transfer

File Download from IQC

IRIG_511Trigger_MHz_10MHz_20091113_154945.xiq

☒ Download I File

☒ Download Q File

☒ Transfer Partial File

☒ Use Markers

10 MHz

Span: 0

Start Marker: 11/13/2009-20:53:56.5017480

End Marker: Last Sample

Start Offset: 0

End Offset: 0

Start - 0 to 13.41153

End - Maximum is 13.42177

A start of 7.2 and end of 10.3 will transfer 3.1 seconds.

Start Transfer

Cancel

The IQC file format is an open file format, allowing the user to parse vital statistics located in the header for personal use.

Naming Convention

The file name is of the following format:

Description_CenterFrequency_CaptureSpan_YYYYMMDD_HHMMSS.xiq

Description -File description entered in capture control

CenterFrequency - Center frequency of capture

CaptureSpan -Bandwidth of capture

YYYYMMDD - Year, Month, Day

HHMMSS - Hours, Minutes, Seconds

Scale Factor

The scale factor is the floating point number that must be multiplied with each I and Q 2 byte signed integer sample to convert that sample back to the real voltage measured on the signal analyzer. Knowing the actual voltage level of the signal is critical when making accurate measurements, and when playing back that signal.

In RSA captures, a 32-bit I and Q representation of that floating point number is parsed from the RSA. So for use with the IQC, the scale factor must be adjusted by 2^{16} because the calculation is based on separate I or Q values.

The calculation to recreate an IQC I sample to real voltage is:

$$I_{sample} \bullet SCF \bullet 65536 = I_{voltage}$$

Where:

I_{sample} = the 16-bit sample value

SCF = the 32-bit scale factor

I_{voltage} is the resultant voltage level for that I sample.

Note: The same relative calculation applies for Q values.

Table 5-4 Format of the.XIQ File

#	Field	Description	Data Type	Length (Bytes)	Beginning Offset	Typical Value	Notes
1	Header Size	Length of header	Integer	2	0x0000	0x4000 (16384)	0x4000
2	X-COM Text	Static text: Title 10 bytes Version 6 bytes	ASCII	16	0x0002	"X-COM IQC v1.2 "	v1.2
3	Span	RSA Span	ASCII	16	0x0012	"Span = 110 MHz "	Discrete RSA Spans
4	Center Frequency	RSA Center Frequency	ASCII	32	0x0022	"Center Frequency = 1 GHz "	13 digits of CF including decimal point *
5	RBW	RSA Resolution Bandwidth	ASCII	16	0x0042	"RBW = 1 MHz "	*
6	SCF	Scale Factor	ASCII	32	0x0052	"SCF = 294.5100573488E-12 "	See "Scale Factor " on page 37.*
7	Format	File Format	ASCII	16	0x0072	"File Format = 1 "	0 – IQC1040 1 – IQC-2110 I 2 – IQC-2110 Q
8	Marker Size	Size of Markers (bytes)	ASCII	18	0x0082	"Marker Size = 26 "	
9	Marker Count	Number of Markers	ASCII	18	0x0094	"Marker Cnt = 0001 "	Range: 0000 - 0511
10	Protect	Protection Field	ASCII	12	0x00A6	"Protect = 0 "	0 – Off, 1 – On IQC Control will prohibit deletion of this file if on.
11	Sample Rate	Sample Rate	ASCII	32	0x00B2	"Sample Rate = 6250000.000000 "	The Sample Rate from the digital source.
12	Reserved	Reserved for future use	Binary	2862	0x00D2		Reserved
13	Markers	<i>Actual Markers: (HEX)</i> Sample Number 2 bytes Event Type 2 bytes Event Count 2 bytes Block Number 4 bytes Year 2 bytes Day 2 bytes Hour 2 bytes Minute 2 bytes Second 2 bytes Milliseconds 2 bytes Microseconds 2 bytes Nanoseconds-unused 2 bytes	Hex	13312	0x0C00		- Markers - - Block Number – (16kB – 32bytes) - Sample Number – Sample number within each block

* Populated when Device Control is enabled in IQC Control.

Figure 21 Sample Breakdown of XIQ File Header, fields 1-11

[illegible]

Note: Column between offsets 06 and 07 is simply a visual spacer.

Updating the IQCServer Software

IQCServer is an application that runs on the I and Q channels of the IQC. Follow these steps to upgrade.

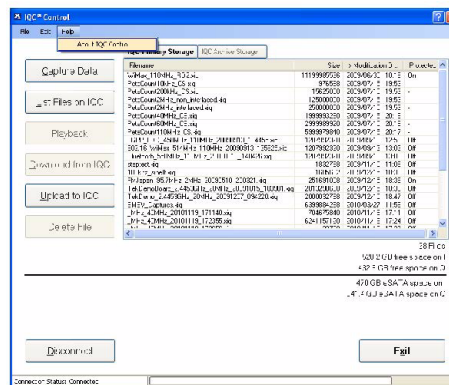
Note: -The ability to upgrade IQCServer is not unlocked during normal use.

1. Access the About menu by going to *Help* → *About IQC Control*.
2. Enter *xcom_server* into the text field in the lower-left corner.
3. Click the button next to it.
4. Click OK.

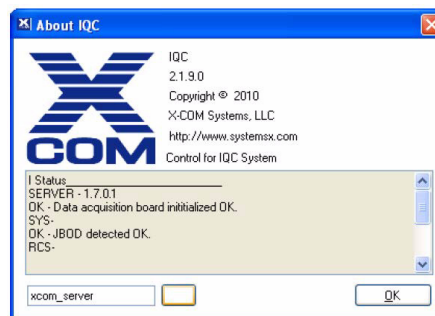
Note: This will unlock the menu in the next step.

5. Access the IQCServer application control menu by going to *Edit* → *Manage IQC-Server Application*.

Note: The current IQCServer for the IQC I and Q channels is shown in the lower-left corner, followed by the timestamp. The list of archived IQCServers is shown to the right.



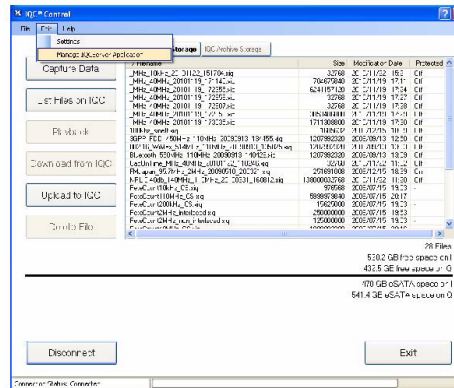
6. Press *Upload New App*, browse to new IQCServer and select.



7. Press *Upload New App* and browse to the IQCServer.exe file to upload.

8. Right-click on the new file and select *Activate This Version of IQCServer*.

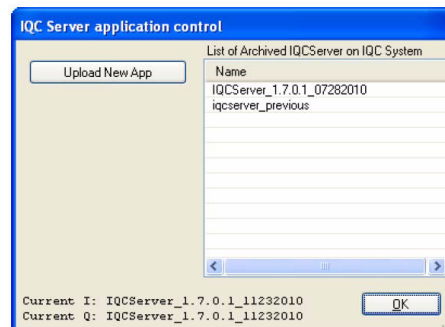
Note: A message warns that the update will not take effect until the IQC has been restarted.



9. Click OK.

Note: The activation will commence and a message will show that the enable has succeeded.

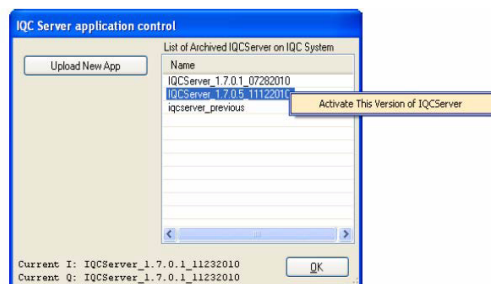
10. Click OK.
11. Access the IQC Settings menu by going to *Edit* → *Settings*.
12. Press the *Restart the IQC* button.
13. Wait for the IQC to restart.



14. Go back to the IQCServer application control by going to *Edit* → *Manage IQCServer Application*.

Note: The current IQCServer for both channels should reflect the upgrade.

Note: The update process also backed up the former version of IQCServer, according to its timestamp. To revert to a previous version, simply repeat the process without uploading.

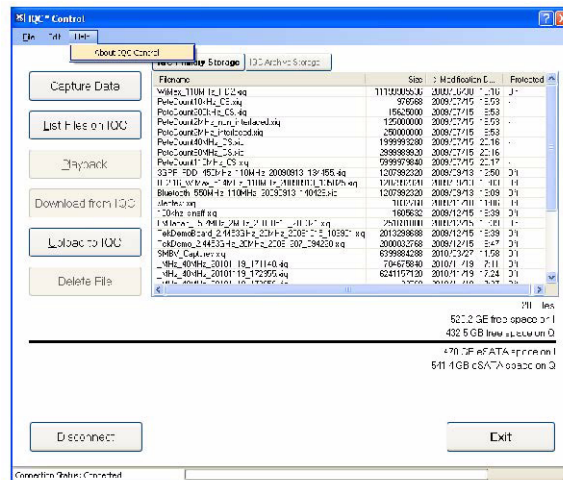


15. Press the *Restart the IQC* button.

Updating the IQC Firmware

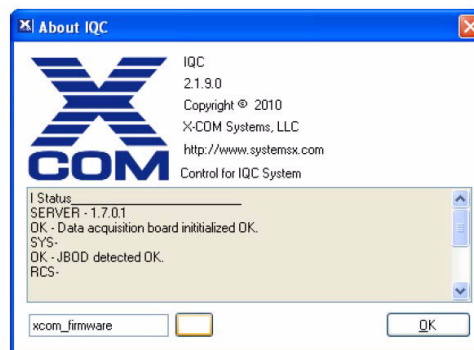
The ability to upgrade the IQC Firmware is not unlocked during normal use.

1. Access the About menu by going to *Help* → *About IQC Control*.



2. Enter `xcom_firmware` into the text field in the lower-left corner.
3. Click the button next to it.
4. Click OK.

Note: This will unlock the menu in the next step.



5. Browse to and select the .xbn file provided by X-COM.

Note: The firmware upgrade will begin. During this time, a readout of the process will show. After a few minutes, the readout should display that the firmware upgrade was successful, and that a restart of the IQC is required.

6. Restart the IQC.

Note: Only a reconfiguration between capture and playback modes is required, but a full power down and back on is recommended.

Note: Notes about IQC firmware upgrade:

- There are 2 types of IQC firmware – capture and playback.
- Capture and playback firmware are managed by IQC Control – the user does not need to select which type of firmware is to be uploaded.

Preventive Maintenance

IQC-2110, DP-HD-XXX, and CPG-2110 require do not require preventive maintenance. If any technical or corrective maintenance needs to be performed, contact Bird Technologies Group customer service.

Replacing Fuse

Note: *The fuse is located in the AC module on the back of the blower.*

1. Correct the fuse burnout cause.

Note: *Common causes include stuck or blocked fans or a short circuit in the motor or blower wiring.*

2. Press the locking tab on the fuse drawer and remove the drawer.
3. Replace the fuse.

Note: *See "Specifications" on page 46 for fuse type and current rating.*

4. Press the drawer into the AC module until it locks into place.

Note: *If the fans still do not run or if the fuse burns out again, return the unit to Bird for service.*

Troubleshooting

WARNING

To avoid personal injury, disconnect the power cord from the AC line before performing any maintenance, including fuse replacement or changing the line voltage setting.

Capture

In capture mode, the span is detected as something different than what the RSA is set to (110MHz, 40MHz).

If you are trying to capture:

a) at a 60MHz span and see 110MHz detected

or

b) at any span 20MHz and below and see 40MHz detected,

then the RSA likely has the digital I/Q out count pattern enabled. This is a test feature, and can be disabled by going to the digital I/Q options screen and changing from count pattern mode to I/Q output ON mode.

Only one of the drives on the Datapack shows when the IQC starts.

Sometimes the external miniSAS cables may feel like they are all the way in, but are not. Try shutting down the IQC, taking out and re-inserting the suspect cable at both ends, and turning on the IQC again.

Networking

Using multiple IQCs, and after connecting to one IQC with a computer, another computer cannot be connected.

The Address Resolution Protocol (ARP) table on the workstation has translated the IQC IP address to the first IQC's MAC address. The second IQC, if it has the same static IP, will not have the same MAC address, and connection will be refused. To rectify this, clear your ARP table by opening an elevated command prompt and executing the command `arp -d`. Then, reconnect to the IQC.

Frequently Asked Questions

Q: Why does the IQC capture longer than I specify on a timed capture? (E.g.: I try to capture for 60 s and end up getting a little more time on playback.)

A: To optimize throughput, due to disk I/O speed limitations, the IQC uses large 512 byte sectors for disk reads and writes. The IQC always stores an even number of 512 byte sectors and never stores less than what is requested. On high samples per second captures (40, 60, and 110MHz) the extra few bytes don't show up because the extra bytes don't add a significant amount of time ($< 10 \mu s$) to show up in IQC Control's playback control. On slower samples per second captures the extra few bytes amount to a greater time factor.

***Example** - On a 5MHz 45.6 second capture, the IQC stores an extra 384 bytes of I and 384 bytes of Q which amounts to an additional 30 microseconds.*

Note: *There is no rounding to the 512th byte on playback. The IQC reads in 512 byte sectors, but can play back the exact amount requested by the user (resolution is to the sample point – 4 bytes).*

Specifications

IQC-2110

Controls Front Panel Rear Panel	System ON/OFF, momentary push button Master Power Toggle Switch
Power	110/230 VAC, 50/60 Hz, 600 W maximum
AC Power Input 115 VAC 230 VAC	110 VAC @ 60 Hz 230 VAC @ 50 Hz
Fuse Rating 115 VAC 230 VAC	IEC 5 x 20 mm Fast acting 10 A 5 A
Cooling Method	Forced Air
Dimensions System Units IQC 2110 External Memory	19" W x 2" H x 17.25" L 4U 2U
Weight IQC 2110 External Memory	35 lbs 25 lbs

Temperature Operating Storage IQC 2110 External Memory	+5°C to +50°C -20°C to +70°C -40°C to +70°C, max gradient 20%/hr
Humidity [*] Operating Non-Operating	5% to 95% non-condensing with a maximum gradient of 20% per hour 5% to 95% non-condensing
Effective Altitude [†] Operating Non-Operating	-200 to +10,000 feet (-60.96 to +3,048 meters) -200 to +40,000 feet (-60.96 to +12,210 meters)

* Assumes no condensation on the drives.

† Relative to sea level.

CPG-2110

AC Power Input 110 VAC 230 VAC	110 VAC @ 60 Hz 230 VAC @ 50 Hz
Fuse Rating 115 VAC 230 VAC	IEC 5 x 20 mm Fast acting 1 A 1 A
Coling Method	Radiative
Dimensions	19" W x 3.5" H x 17.25" L
Weight	14 lb

DP-HDD-XXX

AC Power Input 110 VAC 230 VAC	110 VAC @ 60 Hz 230 VAC @ 50 Hz
Fuse Rating	None
Coling Method	Forced Air
Dimensions	19" W x 3.5" H x 15.75" L
Weight	19 lb

Capture & Playback of FRS 2-Way Radios with the RSA

1. Connect the CPG to the IQC using the LVDS cables.
2. Connect the VSG to the CPG using BNC cables.

Note: *This example requires a commonly available FRS 2-way radio.*

3. Connect a telescopic antenna to the front RF input.
4. Change the displays to show the **DPX Spectrum** and **Amplitude vs. Time** windows.
5. Set the center frequency to 480 MHz with a span of 110 MHz.
6. Power on the 2-way radio and key the microphone.

Note: *A strong signal should be displayed on the DPX display window.*

7. Using the **Amplitude vs. Time** window, set the proper reference level setting.

Note: *The signal should approach the reference line but avoid going 6 dB over due to the overflow that occurs.*

8. Under the Markers tab, click the button **Set Peak** to locate the marker on the peak of the signal.
9. Click on **To Center** to center the RSA marker.

Note: *The RSA markers can be used to quickly center the signal in the display window.*

10. To prepare for capture, set the span to 1 MHz.

Note: *The RSA marker will have to be adjusted again.*

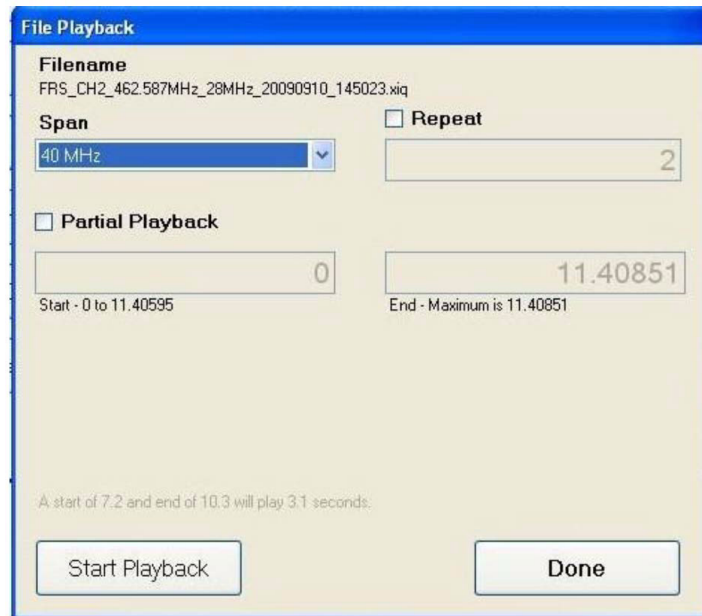
11. Ensure that the **RF Power** and **Modulation** buttons are turned off on the VSG before capturing data.
12. Open the IQC Control Panel.
13. Click on **Capture Data**.
14. Ensure the **Manual** tab is selected.
15. Enter the value of the center frequency and span that corresponds to the settings on the RSA.
16. Press the **Start Capture** button to begin.
17. Press the **End Capture** button to stop the recording.
18. Set the frequency of the VSG to the same center frequency settings recorded on the file.
19. Set the VSG power level to 10 dBm.
20. Ensure the **RF power** button and **Modulation** button are set to on.
21. In the IQC Control Panel, select the **Playback** button.

Note: *When transitioning from capture to playback modes, the green LED on the front of the IQC will flash. When it is solidly lit, the IQC is ready for playback.*

22. Ensure to set the span to the same value as recorded.
23. Select **Repeat** if you wish to continuously loop the playback file.
24. Ensure the 2-way radio is powered on and tuned to the same channel that was recorded.
25. Press the **Start Playback** button.

Note: *The radio should replay what was previously recorded.*

Figure 22 File Playback



Capture & Playback of FM Radio with the RSA

1. Connect the CPG to the IQC using LVDS cables.
2. Connect the VSG to the CPG using BNC cables.
3. Connect a telescopic antenna to the front RF input.
4. Change the displays to show the **DPX Spectrum** and **Amplitude vs. Time** windows.
5. Set the center frequency to an area in the local radio band.

Note: It helps to be familiar with some of the local stations – a center frequency of 97.7 MHz is suitable in the United States) Strong signals should appear on the DPX display window.

6. Using the **Amplitude vs. Time** window, set the proper reference level setting.

Note: The signal should approach the reference line but avoid going 6 dB over due to the overflow that occurs.

7. Under the Markers tab, click the button **Set Peak** to locate the RSA marker on the peak of one of the signals.
8. Click **To Center** to center the marker.

Note: The RSA markers can be used to quickly center the signal in the display window.

Set the span to 40 MHz to prepare for capture.

Note: The RSA marker will have to be adjusted again.

9. Verify that the **RF Power** and **Modulation** buttons are turned off on the VSG before capturing data.
10. Open the IQC Control Panel and click **Capture Data**.
11. Ensure the **Manual** tab is selected.

12. Enter the value of the center frequency and span that corresponds to the settings on the RSA.
13. Press the **Start Capture** button to begin.
14. Press the **End Capture** button to stop recording.
15. Set the frequency of the VSG to the same center frequency settings recorded on the file.
16. Set the VSG power level to 10 dBm.
17. Ensure the **RF power** button and **Modulation** button are set to on.
18. In the IQC Control Panel, select the **Playback** button.
19. Ensure that the span has been set to the same value as the span of the recorded data.
20. Select repeat if you wish to continuously loop the playback file.
21. Press the **Start Playback** button.
22. On the RSA, navigate to **Settings > Audio Demod**.
23. Turn the Audio Demod function on.
24. Select either **FM** or **AM**, according to the broadcast's modulation within the capture that is being listened to.
25. Set the RSA marker to match the frequency of one of the signals.
26. Ensure the volume is turned up both within the Audio Demod module and through the Windows system volume.

Note: *The demodulated radio transmission should be heard. Try centering the marker on other signals captured.*

Statement of Compliance

These instructions are only applicable to IQC-2110's with removable OS drives and are intended to be used with X-COM's SigAnalyst Workstation (SA-WS).

According to NSA Manual 9-12{1}, Sanitization of Solid State drive can be accomplished by:

"Sanitize EEPROM by overwriting all locations with a known unclassified pattern. Verify the overwrite procedure by randomly re-reading the overwritten information to confirm that only the known pattern can be recovered."

The removable drive carrier in the IQC-2110 uses Intel Solid State Drives (SSD). Intel's SSD Toolbox software includes the "secure erase" command that can be issued to the drives from X-COM's SA-WS.

We have contacted Intel to verify that their secure erase does in fact comply with NSA, DoD and NIST standards. Below is their response:

"Our SSD drive supports the SATA "Secure Erase" command, which we believe meets all of these requirements except for AR 380-19. We are making this assumption based upon the following breakdown of the different specs, and within each looking for the applicable section governing Flash memory or EEPROMs. If your understanding of the applicable specifications differs from our view, please let us know which section of each spec applies most accurately to NAND Solid State Drives and we will re-examine our analysis."

DoD 5220.22-M (also NISPOM)

There were two standards we saw could apply, so both are mentioned here:

http://csrc.nist.gov/publications/nistpubs/800-88/NISTSP800-88_rev1.pdf

Definition: Executing the firmware Secure Erase command (for ATA drives only) and degaussing are examples of acceptable methods for purging.

Answer: yes, we fully support the Secure Erase command, so we are compliant here

http://it.ouhsc.edu/policies/documents/infosecurity/DoD_5220.pdf

Definition: Nonvolatile RAM (NOVRAM) – Purge: c, g, or m (c.

Overwrite all addressable locations with a single character., g. Remove all power to include battery power., m. Destroy - Disintegrate, incinerate, pulverize, shred, or melt.)

Answer: yes, our Secure Erase command supports the "c" overwrite with a single character, then "g" and "m" would be done by the operator.

NSA 9-12

http://www.nsa.gov/ia/government/MDG/NSA_CSS_Storage_Device_Declassification_Manual.pdf

Definition: Flash Memory: Sanitize EEPROM by overwriting all locations with a known unclassified pattern.

Verify the overwrite procedure by randomly rereading the overwritten information to confirm that only the known pattern can be recovered.

Answer: yes, our Secure Erase command will overwrite the drive with a known unclassified pattern (all zeros), and confirmation of that programming is built into the Secure Erase algorithm. If you want a second confirmation that the drive contains all zeros, the host system can randomly re-read the drive to verify.

AFSSI5020

<http://jya.com/afssi5020.htm#Chapter%205>

Definition: 5.1.1. Clearing. Erase EEPROM and EAROM on- or off-circuit. Software that controls the EEPROM (i.e., PC Card) must not be active (running) during the erasure. Each manufacturer provides mechanisms for writing commands to place these units into Erase, Program, and Verify modes. In addition, the manufacturer may have its own programming algorithms, protocols, and erase unit sizes. Use the erase procedures provided by the manufacturer.

Normally, this procedure would include pulsing the erase control gate, and verifying the erasure, then, overwriting all bit locations with arbitrary unclassified data.

Answer: yes, our Secure Erase command will run once executed by the host system without more software interaction, and it pulses the erase control gates to clear all data then verifies all data has been erased/programmed with known, unclassified data (all zeros).

Navso 5239

http://www.fas.org/irp/doddir/navy/5239_26.htm

Definition: Electrically Erasable PROM (EEPROM) Overwrite all locations with any pattern or degauss with Type I, II, or other degausser (see 3.4).

Answer: yes, our Secure Erase command will overwrite all locations with a pattern (all zeros).

We have performed verification tests using Intel's secure erase command with our IQC removable OS drive sled. After issuing the secure erase command from Intel's SSD Toolbox we found that all memory addresses were overwritten with zeros.

Sanitization Procedure

Note: These instructions are only applicable to IQC-2110's with removable OS drives.

Tools needed:

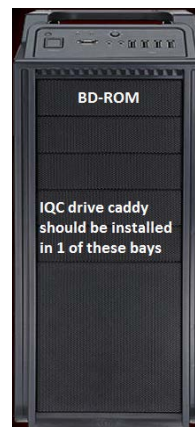
Phillips screwdriver

Software needed:

Intel SSD Toolbox

Hardware needed:

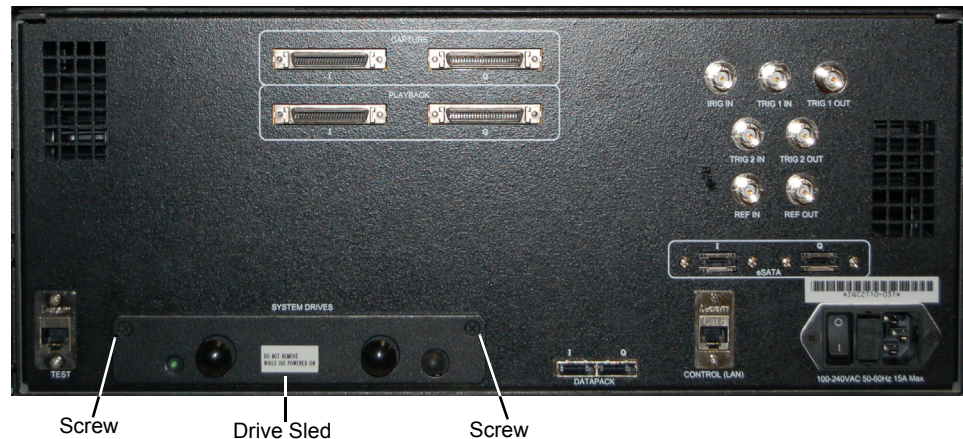
- X-COM SigAnalyst Workstation (WS) with Windows 7 x64
 - Removable OS drive sled installed
 - IQC removable OS drives
1. Install Removable OS Drive sled in X-COM SigAnalyst Workstation.
 - a. Safely shutdown WS and remove from AC power.
 - b. The sled is meant to be installed in the either of the bottom two 5.25" drive bays.



- c. Remove both side panels and front panel following the manufacturer's instruction manual (see appendix).
- d. Remove bay cover from front panel.

Note: The OS drive slide can be found at the bottom center of the rear panel of the IQC-2110. If the sled is not found or the unit does not appear to have them installed (older systems do not have removable drives), contact the X-Com sales department at 703-390-1087 or sales@xcomsystems.com to obtain a quote for retrofitting the system.

- e. Slide sled into drive bay and secure using 2 screws on right side of the bay cage.



- f. Connect SATA Cables from sled to WS motherboard
- g. Connect 6 pin molex to WS power supply
- h. Reattach front and both side panels.
- i. Apply AC power to SA-WS power supply.
- j. Turn on SA-WS and boot into Windows7.
- k. If not already installed, install Intel's SSD Toolbox.

Note: The Intel SSD Toolbox can be downloaded at:
http://downloadcenter.intel.com/Detail_Desc.aspx?agr=Y&DwnldID=18455

- l. Open SSD Toolbox and verify the IQC drives are recognized, Be careful not to confuse the SA-WS SSDs with the IQC SSDs.
- m. Run secure erase command in SSD Toolbox and allow approximately 10 minutes for procedure to complete.

References and standards:

NSA_CSS_Storage_Device_Declassification_Manual.pdf
 DSS Clearing and Sanitization matrix.pdf
 SP800-88_Aug2006.pdf

Miscellaneous references:

Manual_CM_Storm_Scout.pdf

DP-HD-XXX Disk Purging Procedure

Please refer to the website below for approvals and specs of Jetico's BC Total Wipe Out.
<http://www.idealssi.com/bcwipe-2/>

Please read this instruction set in its entirety before proceeding. Contact X-COM with any questions.

Tools Needed

Software

- [Jetico's BC Wipe Total Wipeout 2.0](#) software

Hardware

- X-COM SigAnalyst Workstation (SA-WS) with LSI Logic Host Bus Adapter (HBA) card(s) added to it (See Note Below). Valid model numbers for the HBA include [9201-16e \(LSI00276\)](#) and [9200-8e \(LSI00188\)](#)

OR

- Laptop with ExpressCard 34/54 slot and [Sonnet Tempo SAS ExpressCard 34](#)
- X-COM DP-HDD-XXX
- 2 External Mini-SAS Cables
- USB flash drive (2 GB or larger) **OR** Blank CD

Note: The DP-HDD-XXX is divided into 2 different SAS zones, 1 for IRAID and 1 for QRAID. The LSI HBA is only capable of negotiating with 1 zone at a time. In order to purge both SAS zones at the same time, the SA-WS will need 2 LSI HBA's installed. An HBA is necessary because the Areca RAID cards already installed on the SA-WS are not capable of relaying the ATA_ERASE command to the RAID.

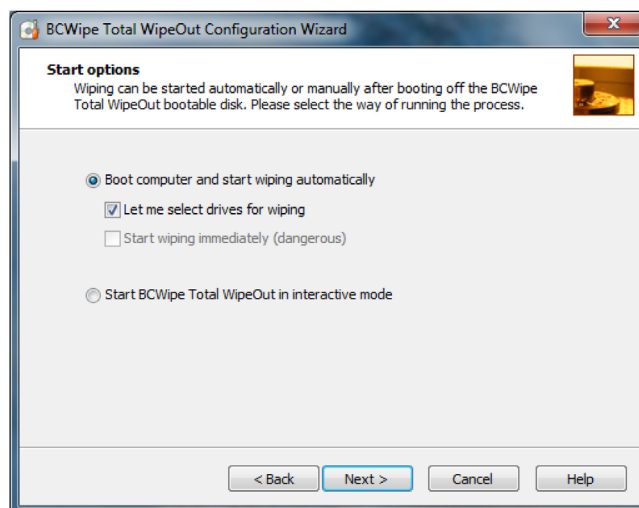
Create Bootable Wiping Tool

Bootable USB Flash Drive

The following instructions should be used to create a Bootable USB flash drive to run BCWipe:

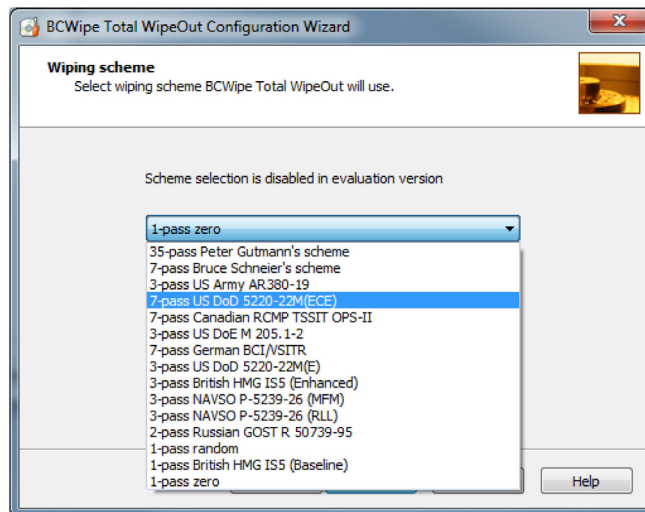
1. Install BCWipe Total Wipe Out 2.0 in Windows.
2. Open Configuration Wizard from START menu.
3. At Start Options Select "Boot computer and start wiping automatically" and check "Let me select drives for wiping".

Note: **DO NOT CHECK** "Start wiping immediately".

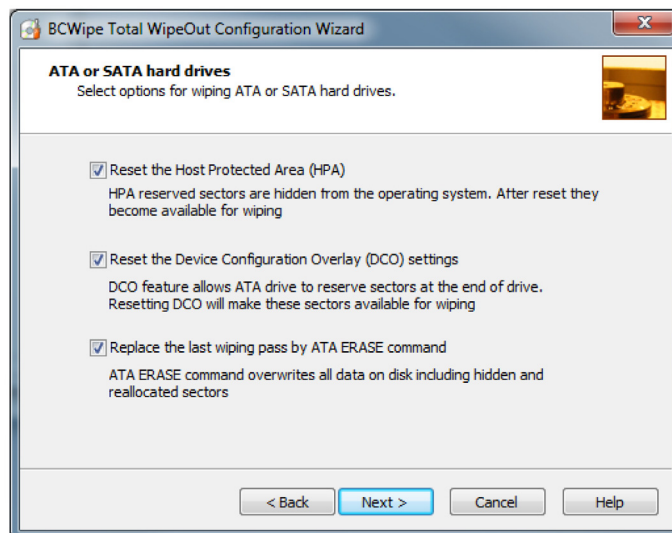


4. At Log Options Check "Write log file to removable USB or floppy disk", Click NEXT.

5. At Wiping scheme, select 7-pass US DoD 5220-22M(ECE) from the drop down menu and check the Enable Verification Box, Click NEXT.



6. Check all three boxes:
 - Reset the Host Protected Area (HPA)
 - Reset the Device Configuration Overlay (DCO) settings
 - Replace the last wiping pass by ATA ERASE Command.



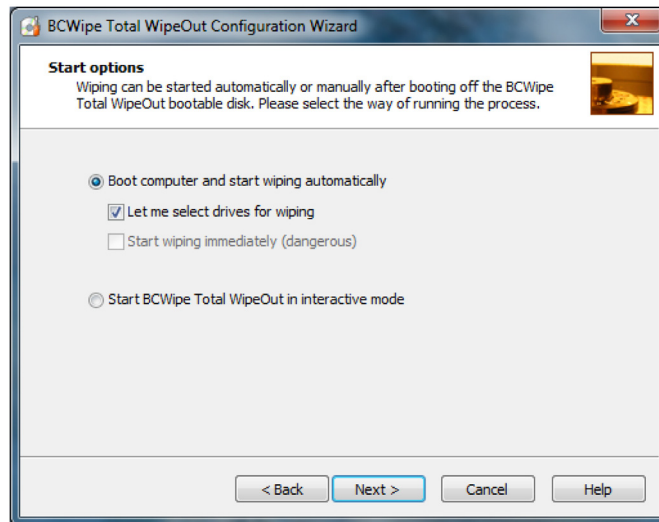
7. Verify your wiping summary is correct and click NEXT.
8. For Bootable Disk Type, select Bootable USB, and insert USB flash drive (must be 2GB or larger capacity drive)
9. Highlight USB Flash Drive and click FORMAT and CREATE. When completed click NEXT.
10. Safely eject and remove your bootable USB drive.

Bootable CD

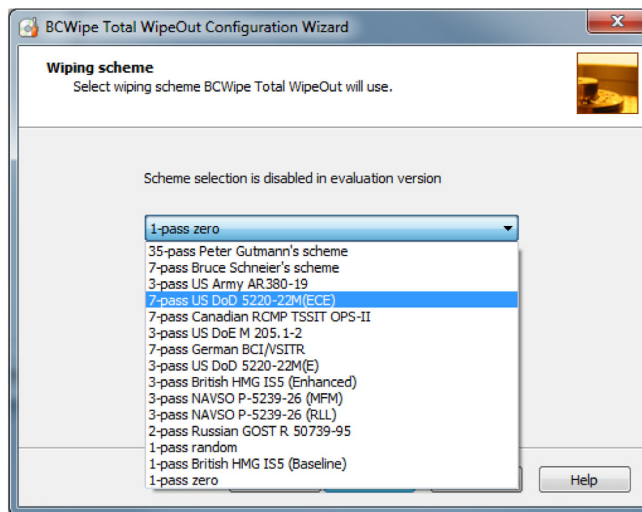
If a USB thumb drive cannot be used due to security reasons in classified areas, a bootable CD can be made instead using the following instructions:

1. Install BCWipe Total Out 2.0 in windows.
2. Open Configuration Wizard from START menu.
3. At Start Options Select *“Boot computer and start wiping automatically”* and check *“Let me select drives for wiping”*.

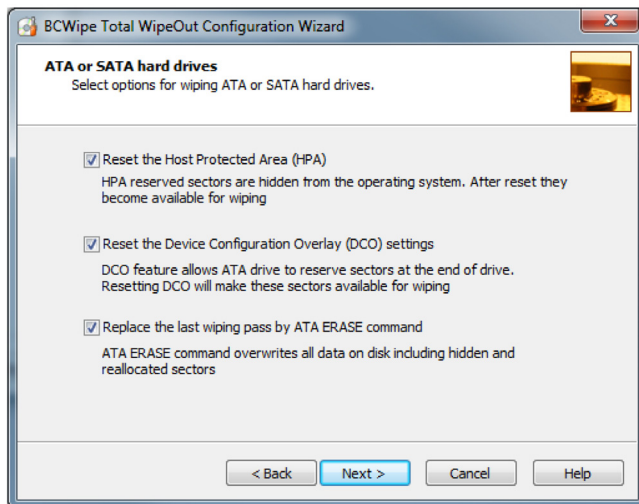
Note: *DO NOT CHECK “Start wiping immediately”*.



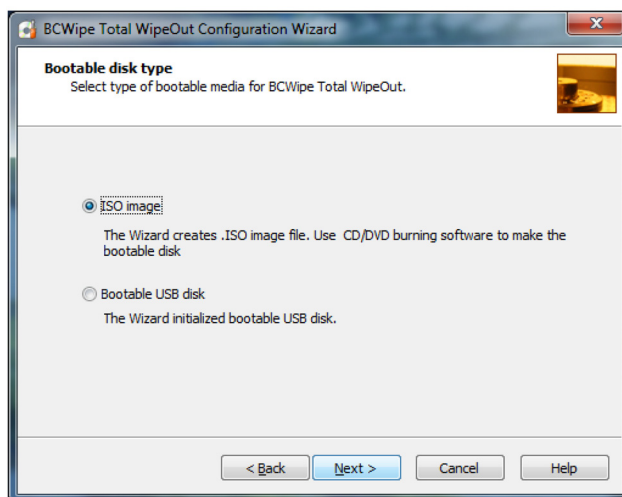
4. At Log Options uncheck *“Write log file to removable USB or floppy disk”*, Click NEXT.
5. At Wiping scheme, select 7-pass US DoD 5220-22M(ECE) from the drop down menu and check the Enable Verification Box, Click NEXT.



6. Check all three boxes:
 - Reset the Host Protected Area (HPA)
 - Reset the Device Configuration Overlay (DCO) settings
 - Replace the last wiping pass by ATA ERASE Command.

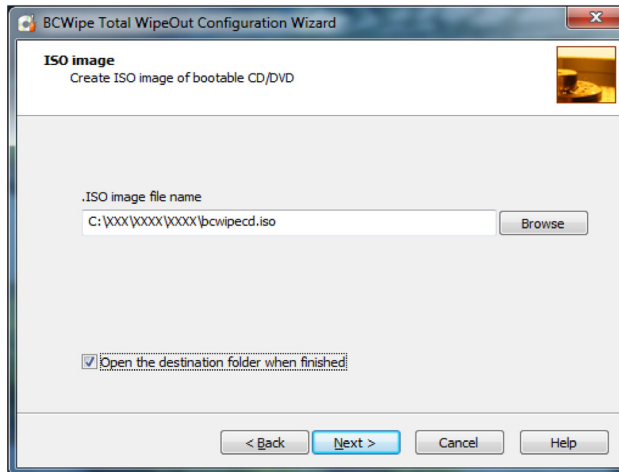


7. Verify your wiping summary is correct and click NEXT.
8. For Bootable Disk Type, select ISO image, and click NEXT.



9. Select the destination and name of the ISO file.

Example - *C:\Users\USER\Documents\BCwipe.iso) and check Open the destination folder when finished, Click NEXT.*



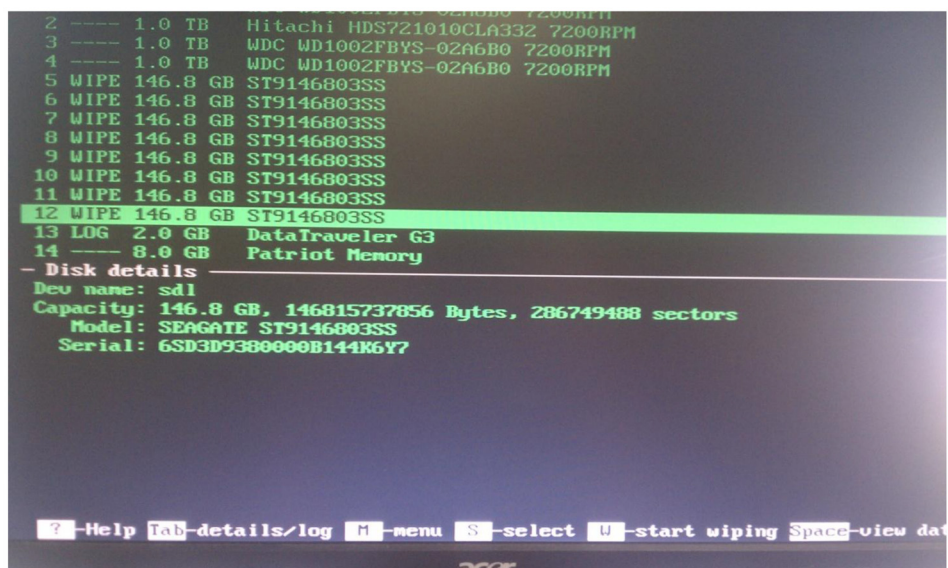
10. The folder with the ISO image should open. Insert blank 700MB CD-R into CD tray and allow ~30 seconds for Windows to recognize the disc.
11. Find the ISO file and right click.
12. Select Burn Image to Disc from drop down menu.

Wipe DP-HDD-XXX using X-COM SA-WS and LSI HBA

CAUTION BEFORE PROCEEDING:

It is **HIGHLY** recommended to disconnect the Storage Archive from SA-WS.
If using a Laptop with Sonnet Tempo SAS Host Controller instead of SA-WS with LSI HBA, the basic process is the same.

1. With SA-WS completely shut down, connect IRAID on DP-HDD-XXX to LSI HBA on SA-WS using External Mini-SAS Cable. (If a second HBA is installed in SA-WS, connect QRAID to 2nd HBA using External Mini-SAS Cables).
2. Apply power and turn on DP-HDD-XXX and allow approximately 30 seconds for disk drives to spin up.
3. Once spin up time is complete, insert bootable USB drive into available USB port on SA-WS. (For bootable CD, insert CD into bootable CD-ROM drive after power is applied to SA-WS).
4. Apply power and turn on SA-WS.
5. At BIOS Splash Screen hit F8 to enter Multi-boot option. **NOTE:** RAID and HBA cards will initialize before entering the multi-boot display
6. Select USB device as boot device and press Enter (or CD-ROM for bootable CD option). Allow 30-60 seconds for BC TotalWipe Out to boot.
7. Once booted you will see a screen similar to figure 3-1.



8. You will see 8 (16 if using 2 HBA's) identical drives for wiping. Highlight each of these drives and press **S**. Ensure each drive has the word **WIPE** next to it.

- The drives in the DP-HDD-XXX are Seagate brand with Model Number structure of:

Figure 23 BC Wipe

Brand Identity	Form Factor	Capacity	Reserved	RPM	Generation	Interface
ST	9	146	8	0	3	SS
ST = Seagate	3 = 3.5" 9 = 2.5" (SAS only)	in GB		0 = 10k 5 = 15k		FC = Fibre Channel LC = 80 Pin (SCA) LVD SCSI LW= 68 Pin LVD SCSI NS = Near-Line storage, SATA/SAS SS = Serial-Attached SCSI

9. It is possible to accidentally erase the OS drives of the SA-WS.

Note: Double-check that the drives selected are the ones intended for wipe, BCWipe will permanently delete all the files. Drives with "----" instead of "WIPE" will forego the wipe process and data will remain intact. If you have any concerns with which drives should be selected please contact X-COM.

10. Once all desired Drives are selected, press **W** to start wiping. Wipe time will vary depending on size of DP-HDD-XXX. For DP-HDD-2TB, wipe time is approximately 20 minutes per pass.
11. If only 1 HBA is installed on the SA-WS or a laptop with the Sonnet Tempo Express-Card is used, repeat these instructions starting at #1 by connecting the QRAID on DP-HDD-XXX (instead of the IRAID) to the LSI HBA on SA-WS using an External Mini-SAS Cable.

LIMITED WARRANTY

All products manufactured by Seller are warranted to be free from defects in material and workmanship for a period of one (1) year, unless otherwise specified, from date of shipment and to conform to applicable specifications, drawings, blueprints and/or samples. Seller's sole obligation under these warranties shall be to issue credit, repair or replace any item or part thereof which is proved to be other than as warranted; no allowance shall be made for any labor charges of Buyer for replacement of parts, adjustment or repairs, or any other work, unless such charges are authorized in advance by Seller.

If Seller's products are claimed to be defective in material or workmanship or not to conform to specifications, drawings, blueprints and/or samples, Seller shall, upon prompt notice thereof, either examine the products where they are located or issue shipping instructions for return to Seller (transportation-charges prepaid by Buyer). In the event any of our products are proved to be other than as warranted, transportation costs (cheapest way) to and from Seller's plant, will be borne by Seller and reimbursement or credit will be made for amounts so expended by Buyer. Every such claim for breach of these warranties shall be deemed to be waived by Buyer unless made in writing within ten (10) days from the date of discovery of the defect.

The above warranties shall not extend to any products or parts thereof which have been subjected to any misuse or neglect, damaged by accident, rendered defective by reason of improper installation or by the performance of repairs or alterations outside of our plant, and shall not apply to any goods or parts thereof furnished by Buyer or acquired from others at Buyer's request and/or to Buyer's specifications. Routine (regularly required) calibration is not covered under this limited warranty. In addition, Seller's warranties do not extend to the failure of tubes, transistors, fuses and batteries, or to other equipment and parts manufactured by others except to the extent of the original manufacturer's warranty to Seller.

The obligations under the foregoing warranties are limited to the precise terms thereof. These warranties provide exclusive remedies, expressly in lieu of all other remedies including claims for special or consequential damages. SELLER NEITHER MAKES NOR ASSUMES ANY OTHER WARRANTY WHATSOEVER, WHETHER EXPRESS, STATUTORY, OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS, AND NO PERSON IS AUTHORIZED TO ASSUME FOR SELLER ANY OBLIGATION OR LIABILITY NOT STRICTLY IN ACCORDANCE WITH THE FOREGOING.

